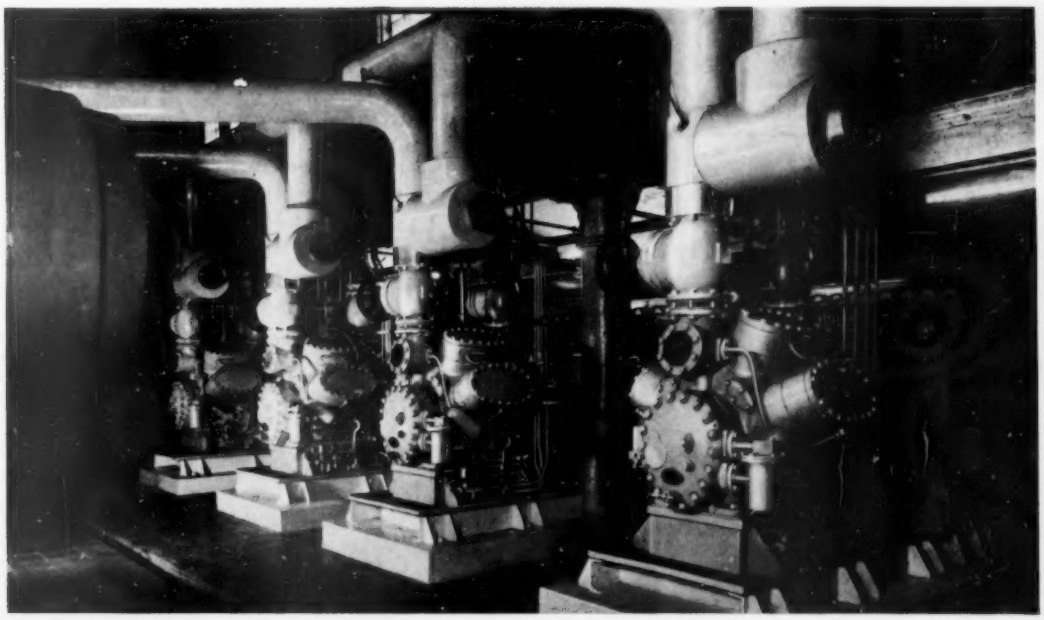
MODERN
REFRIGERATION
AND AIR CONTROL

Vol. 64 No. 754 JANUARY, 1961 Price 2s. 6d. monthly

REFRIGERATION

for manufacturing processes



In brewing, for example, it plays a controlling part in all the processes. The illustration shows the four 8-cylinder, 5" × 4" veebloc compressors, using ammonia as a refrigerant, supplied to Mann, Crossman & Paulin Ltd., Albion Brewery, London, E.C.1.

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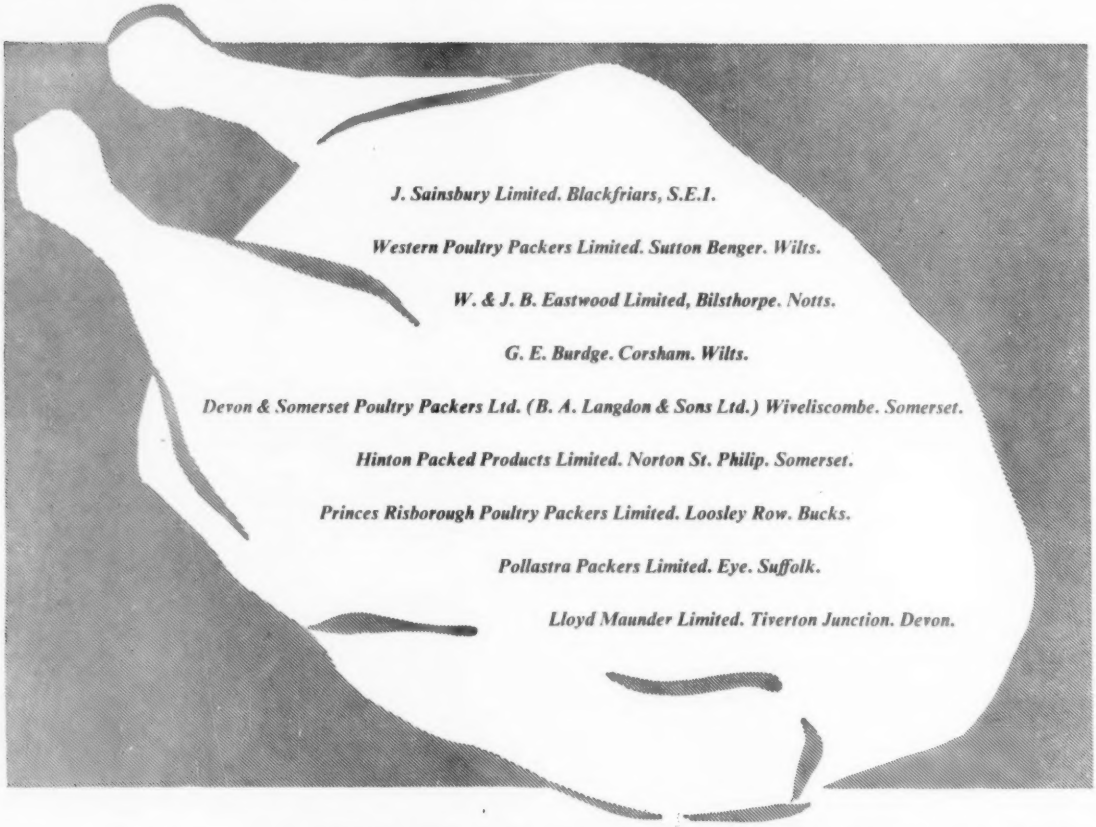

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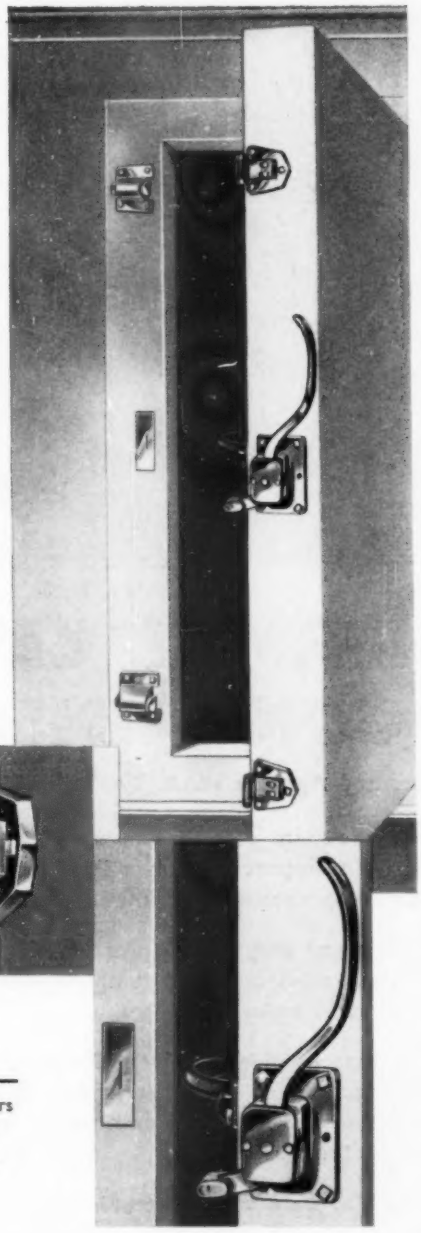

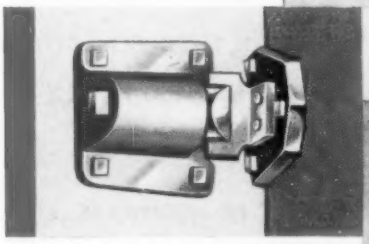

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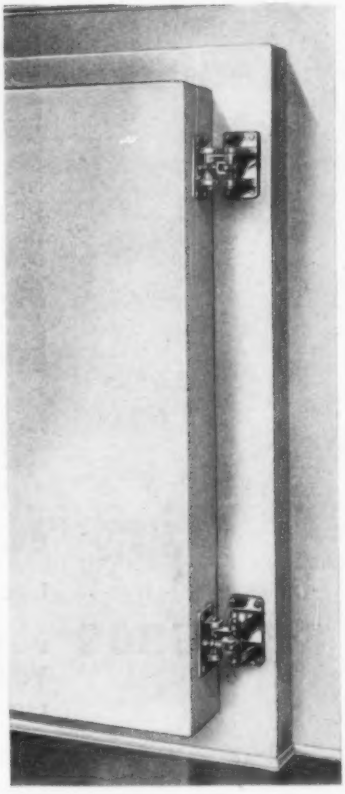

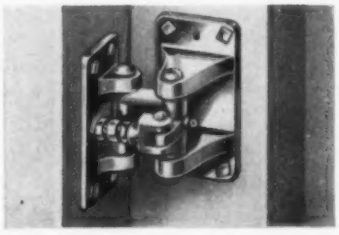

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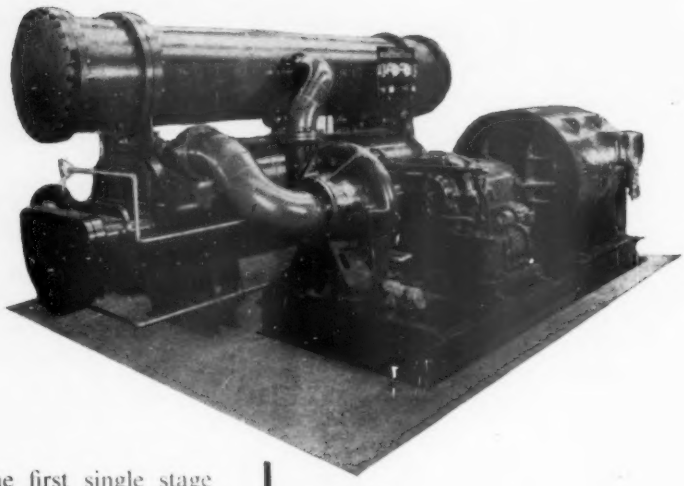

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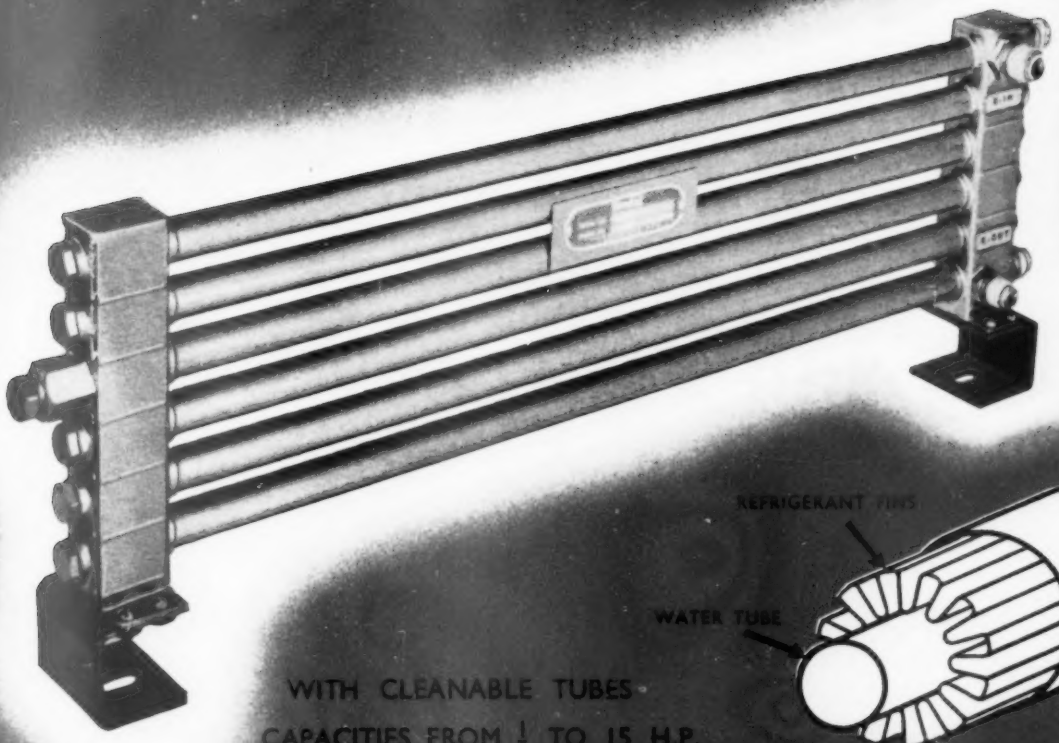

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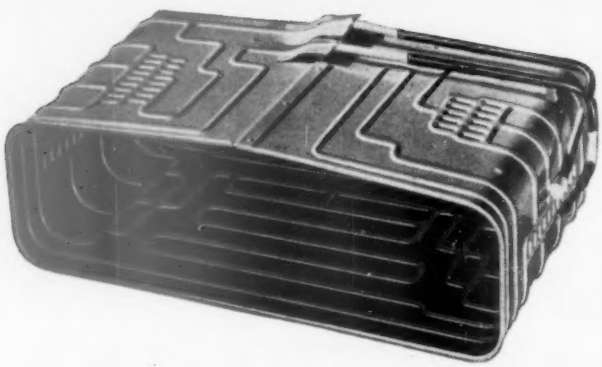

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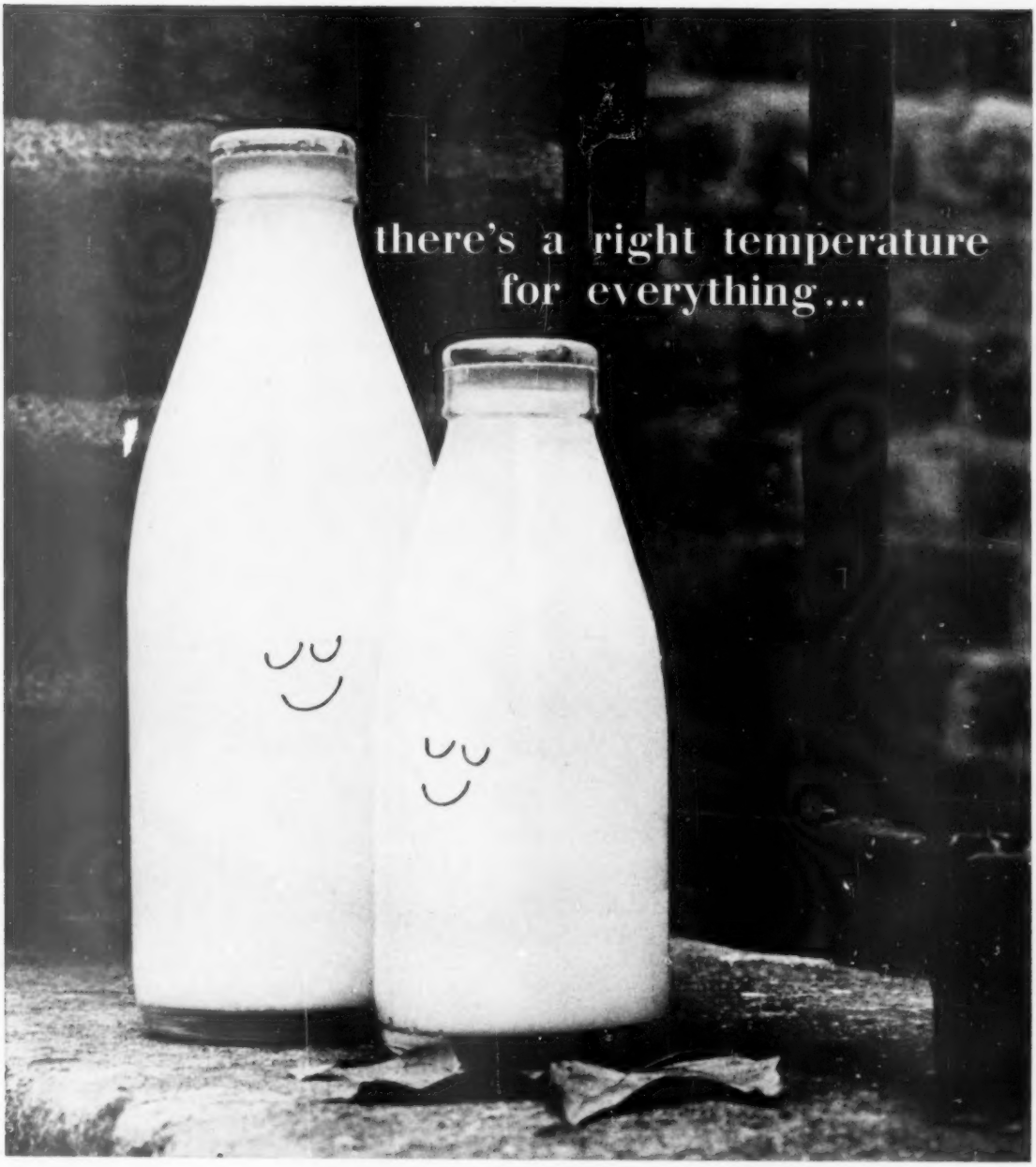

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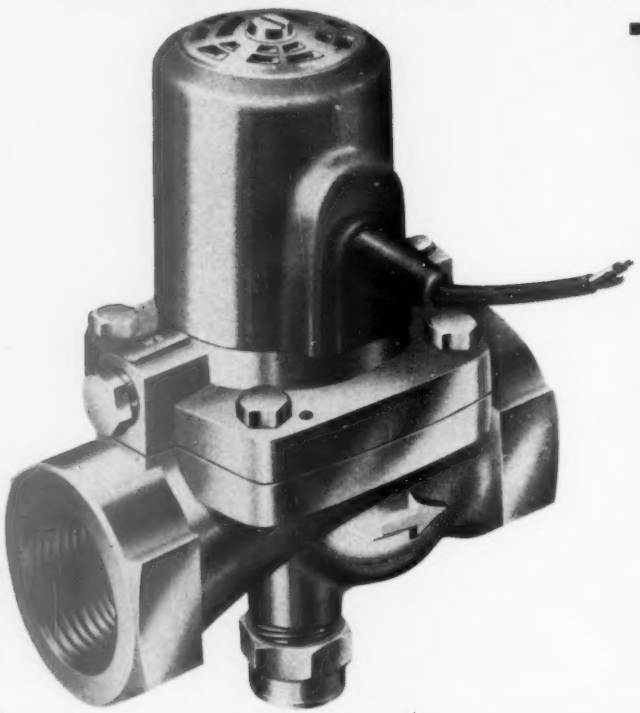

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			Watts	Voltamp. Surge	Voltamp. Steady	Min.	Max.			Design A	Design B
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EVD 25	1 in.								with	32U0232	32U0236

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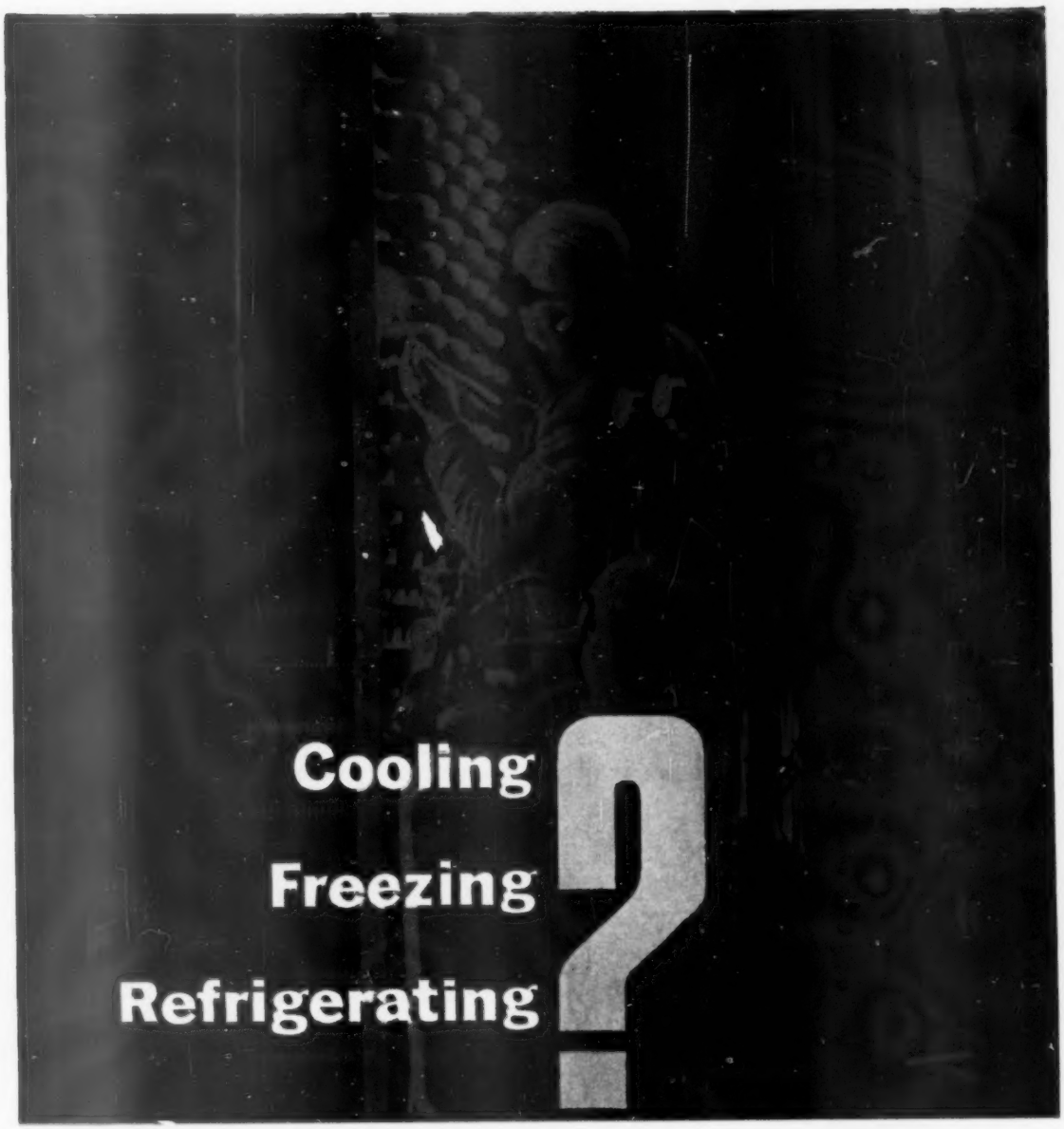

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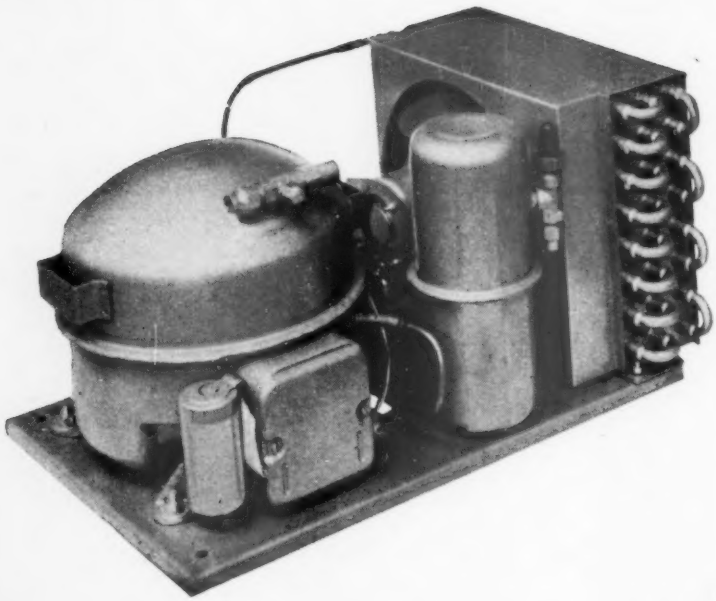

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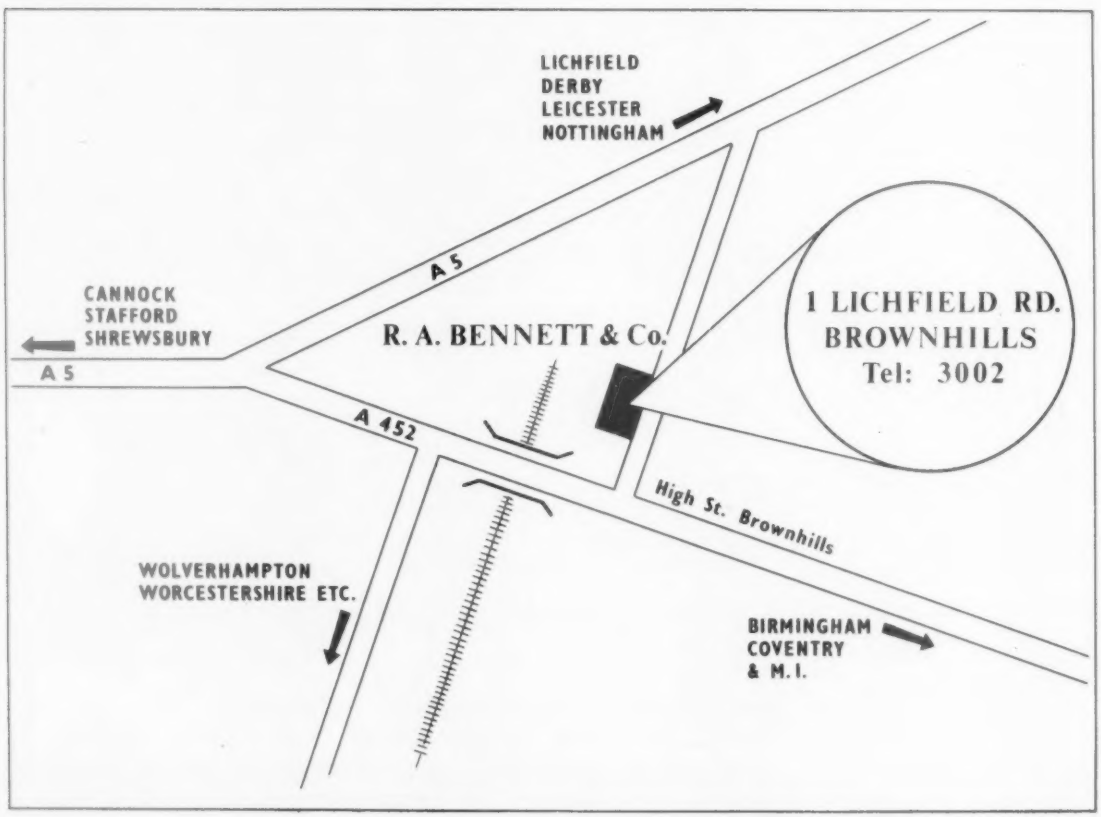
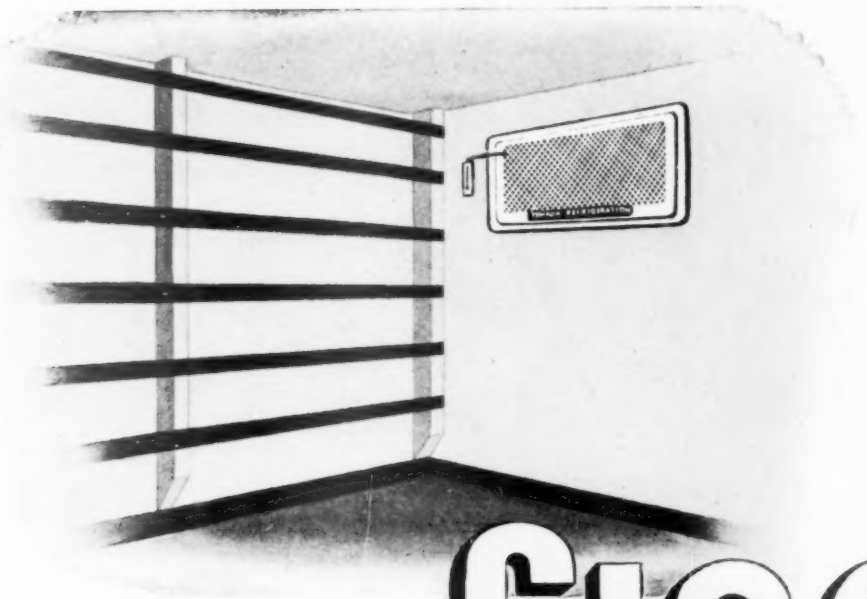


A cold room refrigeration plant



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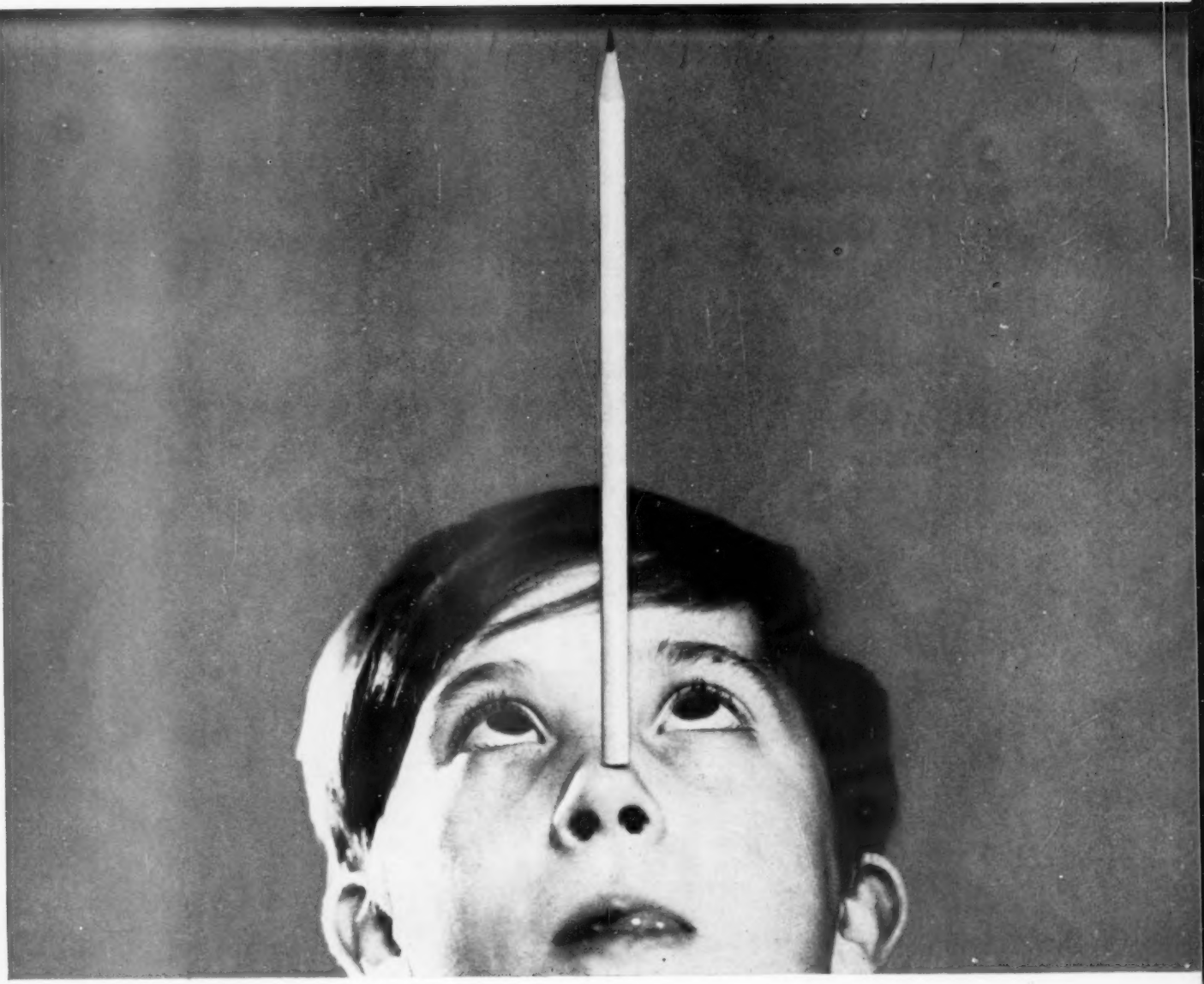

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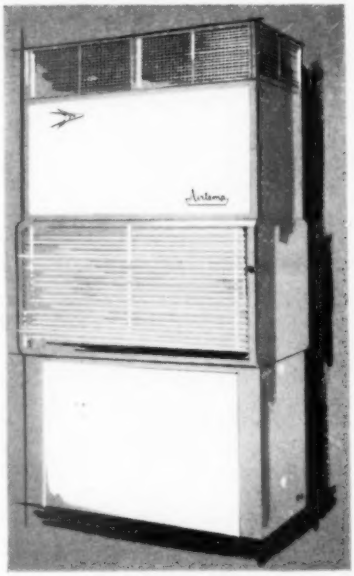

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Established 1898

VOLUME 64 NUMBER 754

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EDITORIAL . . .

Towards pure food

Oven-ready dominance

Rabbit meat reappears

● How often does one hear the charge that artificial fertilizers used in food growing can be blamed for much illness in modern man. Protagonists of this view will be glad to hear that the new British Industrial Biological Research Association's main object is the establishment of a biological research station for investigating the effect of the many substances used in food manufacture, either as processing aids or for flavouring and colouring food, as well as those which may get into food from pesticides, from plant used in food manufacture, from packaging materials, or from utensils. Although some of the larger companies in the food and chemical industries have their own research facilities, until now there has been no national industrial organization in this country with responsibility for work of this kind. There is a lack of data on the effect of these substances on health, particularly when they are ingested in small quantities over a long period of time.

● A considerable amount of scientific and engineering research has been carried out of recent years in the poultry industry with the dominance of the oven-ready bird on the British market. A large number of immersion freezing installations were made in 1959 and 1960. Another freezing system was to be seen at the National Poultry Show in London last month. This is the "Liqui-Flash" method which is based on freezing by the use of proplyene glycol solution which rains upon the product to pierce the freezing barrier. Freezing is about twice as fast as ordinary liquid freezing—ten times as fast as blast freezing, it is claimed. As the liquid temperature may be varied, the colour of the frozen product may be predetermined to any point between chalky white and mahogany. At a temperature of 15 degrees above zero a natural, creamy, flesh colour is obtained.

● What can be claimed to be a major advance in the design of cooling towers was to be seen at the Smithfield Show last month; this is a completely new type of tower, weighing less than half as much as conventional towers of similar capacity. The saving in weight, and in size, is achieved by the use of a revolutionary fill material in which the water is cooled by a counter-current of air as it passes through very closely-spaced elements. As well as the new type of fill, the manufacturers have introduced several novel features in design and construction. The structure is fabricated from rolled steel sections, treated against corrosion, and the casing is of galvanized sheets, with side panels which can be removed for maintenance. The tower, which is circular in shape, contains a top-mounted fan which draws the surrounding air up through it from the bottom. The fill, which resembles a honeycomb in its structure, is arranged across the inside of the tower with the channels disposed vertically, and the cooling air passes up through these channels. The fill, upon which the high capacity/size ratio of the tower depends, was invented by Carl Munters of Sweden. The equipment is described elsewhere in this issue.

● A new meat source is now being developed in Great Britain. Rabbit meat, for years before the war a favourite food with housewives who appreciated high-protein white meat, is coming back to the shops—in oven-ready form, prepared with farm-bred animals, reared to just the right weight and size for the table. The new industry will be centered on East Anglia where a recently-formed company is leading the way with a production and marketing scheme which will soon have thousands of prime rabbits flowing into the nation's larder. For some time there have been scattered producers of meat rabbits, but the industry has never been properly organized because of the lack of a sensible marketing system. Now, the new company has taken the initiative by setting up an organization which will supply either Californian or New Zealand white rabbits to producers, together with housing and feed if required, and which guarantees to buy back every rabbit offered to them. The company will collect and grade the rabbits, and pass them on for processing, quick-freezing and subsequent delivery to the retailers.

● An improved method for cooling electronic equipment on board ship has been under study at the U.S. National Bureau of Standards. The method is based on transferring heat from the equipment cabinet through an intermediate coolant to sea water as the ultimate heat sink. The study has been undertaken for the U.S. Navy Bureau of Ships by P. Meissner of the bureau staff to solve a special design problem in heat transfer, yet this same technique could be applied to other than shipboard equipment, and tap water could be used instead of sea water. The rapidly increasing use of electronics aboard modern naval vessels has placed increased demands on shipboard cooling equipment. Present-day equipment relies for cooling primarily upon compartment air provided by the vessel's ventilating and air conditioning system. The heat generated by these electronic devices imposes a burden on the ship's facilities and could subject the equipment to dangerous overheating in the event of the cooling system being shut down in an emergency. In addition, the exhausting of heated air into the equipment compartment constitutes a hazard to operating personnel. A solution to these problems can be achieved by transferring heat from the equipment to sea water through an independent cooling system, rather than relying upon compartment air.

● Two of Britain's largest companies—Imperial Chemical Industries Limited and the British Petroleum Company Limited—last month announced that they will build large plants in Northern Ireland in the near future. I.C.I. have bought a 200 acre site at Kilroot, near Carrickfergus, Co. Antrim, for a factory for the production of terylene and possibly other man-made fibres. On the opposite side of Belfast Lough, between Belfast and Holywood, Co. Down, B.P. intend to build an £8,000,000 oil refinery to serve consumers not only in the United Kingdom but in some European countries. Viscount Chandos, chairman of the Northern Ireland Development Council and a member of the board of I.C.I., said in London recently: "I hope that the decisions by I.C.I. and B.P. to establish two large plants in Northern Ireland will focus the attention of British industrialists on the potentialities of Northern Ireland as a base for expansion. In the face of this evidence, who can doubt that Northern Ireland is our up-and-coming area for development in the United Kingdom?"

● Operations of Alfred Porter Ltd. will be integrated with William Douglas Ltd. Mr. T. E. M. Douglas, managing director of the Douglas company, will be in charge of the joint operation and Mr. G. F. A. Crook, managing director of Alfred Porter Ltd., will join the Douglas board. This is the third acquisition by Baker Perkins Ltd. in a year. In June it was announced that Rownson Conveyors Ltd., of London and the Granbull Tool Company, of Kingston on Thames, had been acquired. There are now eighteen companies in the group throughout the world, eleven in the United Kingdom.

● A problem connected with the refrigerated display of meat may be close to solution. Under the strong glare associated with the lights in modern emporia and with the cabinet lighting strips themselves, certain sliced meats have often lost their bloom and have become brownish or greyish in appearance. Now, light bulbs can be treated with a liquid to eliminate the harmful rays, and a special preparation for fluorescent lighting is available that absorbs the infra-red rays, thereby reducing the heat given off these, particularly where they are used in enclosed cabinets or showcases. For food shops, especially confectioners and butchers' shops, a coloured variety of this liquid in a number of delicate shades can be used, which not only absorbs the ultra-violet rays but also the infra-red rays, giving adequate protection to foods on show, and at the same time creating an attractive colour scheme to enhance the display.

Laugh with Mulroy in 1961

"I trust that the works party was a thundering success and that I am not too late to wish you charming gentlemen a simply splendid 1961."

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During November, 1960, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £1,056,951 weighing 1,424 tons, was exported from the United Kingdom. Comparable figures for November, 1959, were 1,184 tons, worth £775,696.

* * *

Exports' Analysis.—Of the 1,424 tons of air-conditioning and refrigerating plant worth £1,056,951 exported by Great Britain in November —quoted in the preceding paragraph —110 tons went to the Union of South Africa, 52 tons to India, 141 tons to Australia, 80 tons to New Zealand, 32 tons to Canada, 301 tons to "other Commonwealth countries," 47 tons to Eire, 13 tons to Sweden, 317 tons to Western Germany, 47 tons to the Netherlands, 31 tons to Belgium, 28 tons to France, 31 tons to Italy, and 194 tons to "other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during November, commercial refrigerating machinery accounted for 321 tons, worth £167,311, industrial plant and equipment for 124 tons worth £79,849, and refrigerating machinery, equipment and parts for 642 tons, worth £498,640.

* * *

Exports of Small Refrigerators.—During November, 1,521 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £959,575. The 1,521 tons comprised 111 tons to the Union of South Africa, 23 tons to Rhodesia and Nyasaland, 5 tons to India, 110 tons to New Zealand, 655 tons to "Other Commonwealth countries" and Irish Republic, 66 tons to Sweden, 124 tons to Western Germany, 24 tons to the Netherlands, 2 tons to Belgium, 9 tons to Italy, and 392 tons to "other foreign countries."

* * *

B.R.A. Luncheon.—The British Refrigeration Association announces that arrangements are being made for its annual luncheon to take place on Friday, March 10, 1961, at the Connaught Rooms, Great Queen Street, Kingsway, London, W.C.2. The Right Honourable F. J. Erroll, P.C., M.P., Minister of State, Board of Trade, has accepted an invitation to attend. It is anticipated that the chairman of the Association, Mr. C. M. Marks (managing director of Hussmann British Refrigeration Ltd.) will preside.

* * *

J. & E. HALL'S NEW CHAIRMAN

Succeeding Lord Dudley Gordon as company chairman, Mr. John Frederic Earl d'Anyers Willis joined the board of Hall's in 1959, after spending the greater part of his working life in India. Born in March, 1908, Mr. Willis was educated at Marlborough College and in 1926 joined the staff of Ogilvy Gillanders & Co., Liverpool. In 1928 he went to India to take up an appointment with Gillanders, Arbuthnot & Co., Ltd., Calcutta. In 1959 he was appointed deputy-chairman of the then newly formed Hall-Thermotank Group in that year. The following year he became chairman of Hall-Thermotank Ltd.

Ever-Changing H.P.—Mr. David Carruthers, managing director of L. Sterne & Co. Ltd., took the chair at a dinner in Glasgow on the 29th ultimo, attended by representatives of refrigeration companies in Scotland. The opportunity was taken of presenting prizes given by the British Refrigeration Association to students on the refrigeration course at the Stow College of Engineering. The director of the British Refrigeration Association was present and said: "Since the British refrigeration industry got into its post-war stride in 1948 it has produced refrigeration equipment to a value exceeding £550,000,000, nearly 40 per cent of which has been exported. If the industry is to respond to the appeals by the Government to cultivate export markets even more intensively then it must insist upon the Government looking after the home market more carefully. The industry has already had fifteen changes in its purchase tax and hire purchase arrangements and only one change can upset the home market very seriously."

Soviet Technicians' Visit.—For the first time, Russian technicians have offered to lecture to British industry. Following the recent successful visit to Moscow by a 12-man delegation representing seven leading British companies, the organizer, Mr. Greville Wynne, an industrial sales consultant, has been asked to co-ordinate arrangements for a reciprocal visit by Russian industrial representatives in April. The party, which will be organized on the Russian side by Mr. Wynne in conjunction with the State Scientific and Technical Committee of the U.S.S.R. Council of Ministers, will spend two days in London and will then divide according to the industries represented. These industries will correspond with those of the British delegates who visited Moscow last month and the seven companies are making arrangements for the Russian technicians to tour their factories. The Russians will lecture to English technicians and engineers, on the latest developments in Soviet industry, in the various centres where their hosts have factories, i.e. Sheffield, Leeds, Co. Durham, Wolverhampton, Wallsend and London. During their recent visit to Russia the British delegates were given the opportunity of visiting Russian factories and representatives of each company lectured to Russians working in the same industry.

* * *

The new factory at Irwell Bank Mills, Stoneclough, Radcliffe, near Manchester of **A. J. Flatley Ltd.,** forms the latest chapter in a story that began when Mr. A. J. Flatley, then a 40-year-old textile salesman, bought a drying cabinet to ease the washday burden of his wife, Evelyn, whose family chores included the washing for their four small daughters. Worried by the high price of the equipment—£40—Mr. Flatley made a cabinet of his own in his back garden workshop. Even when made by hand and on a small scale, it could be retailed for £12. Mr. Flatley made his first drying cabinets with the help of half a dozen workers, and personally sold them door-to-door in the evenings, after long days spent in his basement workshop. The Flatley refrigerator has been described as "The most fantastic Flatley of all." This cabinet contains over 4½ c.ft. of storage space. Refrigeration is by the internationally famous "Sternette" sealed compressor unit and retails a yet 39 guineas.

REFRIGERATED "VOLKS"

VW Motors Ltd., London, N.W.8, the British company which handles U.K. distribution of the German Volkswagen, has recently introduced a new version of its well-known van incorporating a refrigerated body of a size which would recommend it for use on localized wholesaler/retailer distribution or retailer delivery sales for frozen foods. The refrigeration unit comprises a piston compressor with two cylinders, a coolant receiver and the drive units. It is powered by the vehicle's engine—when running—or, for stationary operation, by a built-in electric motor which can be plugged to the local power system.

PICTURE OF THE MONTH

This photograph of a Ross Frozen Foods refrigerated vehicle going aboard the "Bardic Ferry" at Tilbury taking a consignment of quick-frozen fish direct to a cold store in Antwerp, marks an interesting development in refrigerated transport. This service ensures a much better delivery over the independent food container. Latest information confirms that the frozen foods arrive in first-class condition when sent in a refrigerated vehicle from cold store to cold store and Ross will probably expand considerably direct deliveries to the Continent. This issue carries a review, starting on page 55, of transport developments.

Cellar Cooling Development

Interesting New Installation in London

LONDONERS, we are told, are rapidly losing any taste they may once have had for warm beer—if indeed such a taste was ever any more than an American music-hall joke. This is the opinion of Friary Meux, whose "Crown" Hotel in Charing Cross Road was reopened on Monday evening, November 21, complete with a new "Temkon" beer cellar cooler manufactured by Temperature Limited of Fulham.

Such a unit is a virtual necessity, said a spokesman of Friary Meux, in the cellars of most London public houses if the beer is to be served throughout the year at the constant, palatable temperature demanded by the customers.

During the past six months the interior of the "Crown" has been completely gutted and modernized; the ground floor has been replanned to include a single central bar together with a snack bar along one wall, while on the first floor there will be a new "Crown" restuarant. As the "Crown" lies at the heart of London's theatre-land the facilities have been planned with the needs of the theatre-goer and West End tourist very much in mind. The bar gives a great sense of comfort and spaciousness, furnished with rose-pink chairs and stools, whose colours are repeated in the Tudor roses which form the ceiling motif.

The refurbishing of the "Crown" is part of a wider scheme to bring up to date many Meux houses throughout London; some 10 buildings have been similarly modernized in the last five years.

Architects for the modernization were Friary Meux Architects Department and the main contracters were William Brown and Sons (Builders) Limited.

The "Temkon" self-contained, electrically powered beer and wine cellar cooler is designed for use in ambient temperatures up to 95° F. An easily adjusted thermostat keeps cellar temperature at any required level between 50° F. and 60° F.

Water- or air-cooled models are available, of 1½ and 2 h.p., with either the cleanable double all-copper tube contraflow water-cooled condenser, or a liberally rated air-cooled condenser.

The "Temkon" unit is simple to install, since it is supplied ready piped, wired and complete with installation kit. The complete unit measures only 30¾ in. wide × 29 in. deep by 18 in. high.

The refrigeration system is hermetically sealed and refrigerant control is by capillary tube, thereby insuring that the "Temkon" requires a minimum of attention once it is installed. It also features automatic defrosting by means of an in-built thermostat which stops and starts the compressor while allowing the evaporator fan airflow to defrost the coil.

"Temkon" equipment is, of course, made by Temperature Ltd. of London.

A general view of the bar at the recently reopened "Crown" Hotel in Charing Cross Road.

ECONOMIC COMPARISON OF WATER- AND AIR-COOLED CONDENSERS

D. PNUELI* and R. LANDSBERG†

Israel Institute of Technology, Haifa

Parallel series of tests have been carried out on a laboratory refrigeration plant working alternatively with a water-cooled and an air-cooled condenser. The tests prove a constant ratio between actual and idealized coefficients of performance. This leads to a system of equations for the economic comparison of the two condenser types. The advantage of the air-cooled condenser is established for a wide range of climate and load conditions.

Symbols :

- k ratio between actual and idealized COP ; k_A for air cooling, k_w for water cooling
- m yearly operation time factor = operating hours per year divided by 8760
- q_o refrigeration output, kcal/h
- q_c rejected condenser heat, kcal/h
- COP coefficient of performance, see ϵ and ϵ^* below
- N nominal compressor size, h.p.
- Q_o yearly refrigeration demand, kcal/year
- Q_t monthly refrigeration demand, kcal/month
- P_o suction pressure
- P condenser pressure
- α load and climate factor ; α_a, α_b, α_c, for load types a, b, c ; see part 3
- ϵ measured COP = refrigeration output divided by electric energy consumed by compressor motor
- ϵ^* idealized COP (5° C initial superheat, isentropic compression, 5° C sub-cooling, isenthalpic expansion)
- $\bar{\epsilon}$ yearly mean COP
- τ monthly operating time, hours/month

1.—Experimental Work

The present comparison between water-cooled and air-cooled condensers endeavours to take into account the influence of climate and load variations which seems to have been disregarded so far [1, 2]. The work started with tests carried out at the Israel Institute of Technology on a 3 h.p. refrigeration plant having both types of condensers which could be connected alternatively. A D.E. water chiller with suction pressure control (by-passed above freezing temperature) formed the low side.

In view of space limitations, only the essential conclusions from the tests can be stated here. The tests confirm the linear increase of the power required with the refrigeration output. In addition, there exists a practically constant ratio between actual and idealized coefficients of performance (fig. 1), similar to a relationship published recently elsewhere [3].

2.—Climate and Load

With the aid of this constant ratio it became possible to proceed beyond the limitations of the tests and to investigate the influence of the seasonal variations in condenser operation imposed by outside temperature and humidity. This paper will deal with three types of climate [4] :—(1) Mediterranean Coast, summer temperatures rarely exceeding 30° C. (86° F.), fairly high humidity during the entire year, winter mean about 13° C. (55° F.) ; (2) Jerusalem, hill climate, warm and dry summer days, cool nights, cold winters ; (3) Red Sea Coast (Eilat), summer > 40° C. (104° F.), humidity <20 per cent, mild winter.

On this basis the condenser pressure was calculated, with temperature differences as shown in table I. In addition, in order to figure year-round consumption, it was necessary to make some simplified assumptions about the load types so as to allow for interpolation in practical cases. The three types are :

(*a*) Constant refrigeration load, *e.g.* an industrial cooling process.

(*b*) Refrigeration load varying in proportion to the temperature excess above 20° C. (68° F.),—extreme case of short-time cold storage ceasing during the cold season.

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* M.S., Assistant. This paper is an extract from the Master's Thesis.

† Dr.-Ing., Associate Professor.

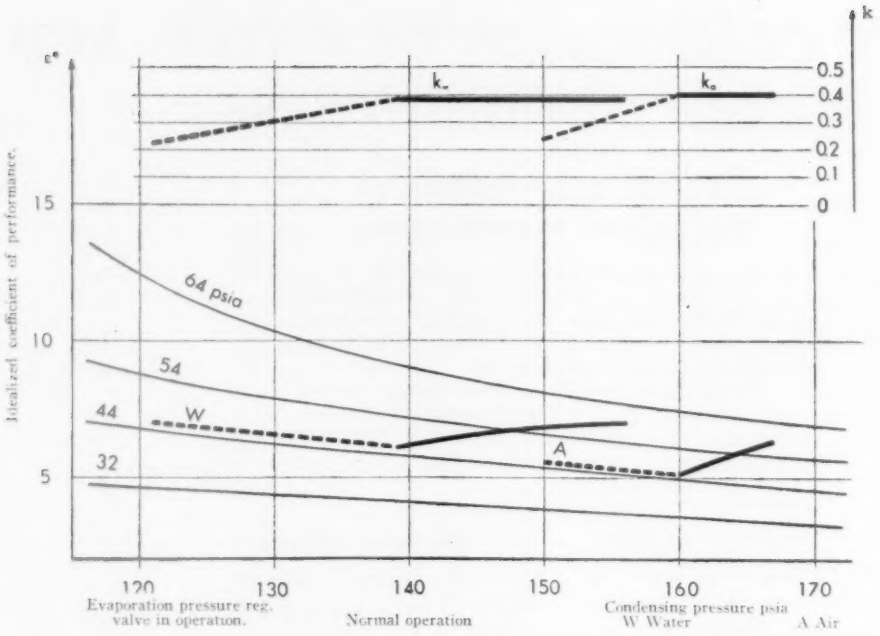

Fig. 1.—Ratio of actual and idealized coefficient of performance.

(*c*) Air-conditioning, varying as per (*b*),—approximately correct for a plant with about one-half transmission and outside air, one-half occupancy load.

3.—The "Load and Climate Factor"

For the purpose of the final comparison of operating expenses, a factor has been introduced, defined as the ratio of yearly full load operating hours to 8760 (hours per year). For a given demand and plant, this factor depends on a "Load and Climate Factor" a :

$$m = Q_o/aN \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

To determine a, case (*a*) requires only consideration of the seasonally varying condenser pressure which influences the hourly refrigeration capacity. This causes variations of the monthly running time

$$\tau = Q_o/12q_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Consequently, for the year :

$$m = \Sigma\tau/8760 \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Heat rejection per hour may be considered constant during the whole year, since with decreasing pressure the sub-cooling temperature and the power input drop to about the same extent ; in other words, the increase of ϵ and q_o in

$$q_o = \frac{1+\epsilon}{\epsilon} q_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

cancel each other. Thus exists a constant ratio determined from test results as

$$q_o = 1650\,N \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Eqs. (1) to (5) combine to

$$m = Q_o/a_aN = Q_o\,[12+\Sigma(1+1/\epsilon)]/174\times10^6\,N \quad (6)$$

In cases (*b*) and (*c*), the monthly load variation must be calculated, leading to

$$\tau = Q_i/q_o \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

and the final form for case (*b*), using eqs. (3) to (5) as before :

$$m = Q_o/a_bN = \Sigma[Q_i\,(1+1/\epsilon)]/14{\cdot}5\times10^6\,N \quad \ldots (8)$$

Due to greater heat rejection in case of air-conditioning, case (*c*) has been computed with

$$q_c \approx 2300\,N \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$m = Q_o/a_cN = \Sigma[Q_i\,(1+1/\epsilon)]/20{\cdot}2\times10^6\,N \quad \ldots (10)$$

Eqs. (8) and (10) do not arithmetically exclude the possibility of compensating lower load during cooler months by excessive running time during the hot months. Since the equipment will have been selected for near-maximum load, the operation time must remain below a certain value m_{max}.

These various factors have been summarized in Table II which is based on month-by-month computations. They have to be used in conjunction with

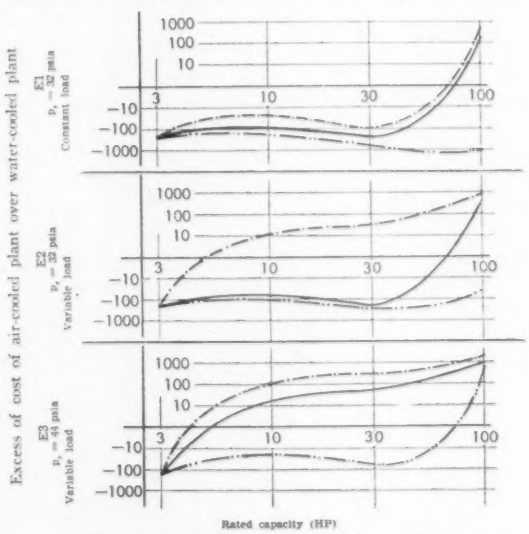

Fig. 2.—Jerusalem coastal plain Eilat.

fig. 2. As an example, a 50 h.p. air-conditioning plant in Jerusalem, case (*c*), may require 185×10^6 kcal/yr. From Table II, water-cooled condenser ; $a_c = 14{\cdot}7 \times 10^6$; $m_{max} = 26$ per cent ; this $Q_o/a = 12{\cdot}6$. Fig. 2 shows m = 25 per cent which remains below the limit stated and will enter the final comparison.

It will be noted that eqs. (5) and (9) state relatively low rates of heat rejection. These figures are based on tests made with a comparatively small machine ; they may improve with increasing size and through the use of a suction-liquid heat exchanger which promises advantage [5], especially with the air-cooled condenser. This is now being studied ; results obtained so far confirm the expectations.

4.—Final Comparison

The final analysis includes operating costs on the basis of m, utility rates (Table III) with make-up water estimated at 3 per cent of the circulating quantity, and auxiliaries (10 per cent of compressor motor input for pump and cooling tower fans ; 4 per cent for condenser fans). Initial costs are practically equal for both condenser types between 10 and 30 h.p. Large air-cooled condensers seem disproportionately expensive, and the difference is accentuated by a high purchasing tax existing in Israel at present. 20 per cent are allowed for depreciation, interest, maintenance, etc.

Computations were made for 3 ; 10 ; 30 ; 100 h.p., and the points obtained connected by assumed smooth curves (fig. 3). They show that the air-cooled condenser remains advantageous in all cases up to 5 h.p. For greater capacities, the relative duration of high load and low humidity decides the issue. In the hill climate of Jerusalem, with low humidity and moderate temperatures, the air-cooled condenser is more economical. The same applies, except for air-conditioning, along the Mediterranean Coast, up to about 50 h.p. At the Red Sea Coast the low humidity of very high temperatures works in favour of water cooling except for the extreme case of year-round constant load.

Further study suggests that even in those cases where the present study favours the water-cooled condenser, a substantial increase of the air-cooled condenser surface is likely to reverse the situation, especially when accompanied by a more logical price structure for larger units.

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Temperature Maintenance and Cold Store Construction

N.A.W.D.O.F.F. CONVENTION PAPER

After making some reference to frost heave and its remedies, and to some of the factors involved in selecting or specifying refrigerated and insulated vehicles, Mr. I. M. Rae turned his attention to the taking of temperatures, speaking before a recent conference of The National Association of Wholesalers Distributors of Frozen Foods.

Those engaged in the delivery or selling of quick-frozen foods should always pay great attention to the actual rather than the theoretical temperatures at which the goods were kept while in their care. A useful guide in this field when dealing with vehicles or with cold stores was the temperature of the atmosphere inside the insulated space, and this could quite adequately be taken by hanging up a standard mercury glass thermometer, taking readings periodically and maintaining a temperature log of the readings. Alternatively, such temperatures could be taken by distant reading dial thermometers or electronic equipment.

At this point, the speaker drew attention to some of the shortcomings of mercury thermometers and similar instruments for taking temperatures of the products themselves.

" The best type of equipment to use for product temperatures is an electronic device known as a thermophil, or similar thermocouple equipment is very effective. Unfortunately, these instruments are relatively expensive, but they do give accurate and instantaneous readings, and where a number of readings is desirable, an instantaneous result is necessary.

New Hotel Cocktail-Cabinets.—A built-in cocktail cabinet, with a refrigerator in the lower compartment and a storage cabinet above, is a special feature of each of the sitting-rooms in six redesigned luxury suites at Grosvenor House. The refrigerator ensures visitors a constant supply of ice and iced bottles while other cocktail accessories are stored conveniently in the upper compartment. The 2 c.ft. Lec refrigerator, which is concealed by cherry-veneered doors, is equipped with shelves arranged to hold the maximum number of bottles. Special shelves were made for this purpose of perforated sheet steel covered with polythene. Vents in the skirting-board and above the refrigerator allow a free circulation of air. An Ashburton marble shelf between the two compartments provides a surface for serving drinks while the upper cabinet, which has two cherry shelves for glasses and unchilled bottles, has shaped wooden fitments on the insides of the cherry-veneered doors for storing cocktail utensils.

The Graphical Analysis of Air-Conditioning Proposals

By H. Mervyn Meacock, M.Inst.R., M.R.S.H., A.M.I.I.F.

AIR-CONDITIONING is growing so rapidly in its application that enquiries are continually being received for bigger and bigger projects with little or no accumulated experience to guide either the quoter or the quotee. These articles are designed to serve as general sign posts indicating the direction in which the most economic layout may be sought.

Faced with an enquiry to provide air-conditioning for a group of, say, forty houses in tropical conditions it is not easy for the sales engineer to know where to start and on the obverse side of the coin it is equally difficult for a consultant to decide whether a central chilled water plant is more advantageous than a mass of window type units. There is no doubt that the sales staff of a company offering either proposition would be well briefed on the particular advantages of the type which their principals are putting forward but it is felt that some more concrete means of evaluation is required.

The number of variables which control the eventual choice of the type and system of air-conditioning is enormous and some means of setting their relative economic merits side by side for comparison should prove useful.

There seems to be no logical order in which these variables can be considered and graphic solutions to a number of problems are put forward. Some of these are based on many years of records and experience while others are simple commonsense comparisons put in to a convenient form. The problems which these charts seek to solve are in general related to installations involving medium to large tonnage since the small tonnages offer less choice and the sums involved do not warrant lengthy investigation.

Estimation of Building Heat Gains

An approximate but reasonably close estimate of the load to be handled is obviously a first requirement. Heat gain calculations are tedious and time-consuming but there is ultimately no substitute and all the parameters required for estimating heat gains by means of figure (1) would be used in the final detailed analysis so that if the record is kept no time will have been wasted.

Figure (1) gives a quick method making rough estimates for average brick built structures in ambient temperatures of 110° F. with normal tropical sun load. The method is sufficiently accurate to give a working approximation on which to base the initial investigations.

Before using the chart it is necessary to compute the following:

1. The area of the plan (sq. ft.)
2. The perimeter (ft.)
3. The ratio of item 1: to item 2.
4. The fenestration ratio (%)
5. The building height (ft.)
6. The volume (c.ft.)
7. The number of occupants
8. The ambient wet bulb temperature (° F.)

Given these figures the procedure is as indicated on the example.

Let 1) = 15,700 sq. ft.
2) = 816 ft., then
3) = 19.
4) = 15%
5) = 50 ft.
6) = 750,000 c.ft.
7) = 250
8) = 85° F.

The procedure is first, at the intersection of the vertical line 19 and 15% fenestration factor read the value 12 on the left. Secondly, going vertically from the height (50) read the value 2 and add this to 12= 14. Thirdly, join 14 and the building volume (750,000) and read the heat gain tonnage.

Now join the ambient air temperature (85° F.) with the number of occupants (250) and read the occupancy tonnage—98 tons.

Total approximate load 198 tons.

The occupancy figure includes the heat gain due to occupants engaged in moderate movement and takes account of cooling 40 cfm. of outside air for each person from the wet bulb temperature.

The method of cooling which is *prima facie* the simplest and cheapest whether for a large block of buildings, an estate of separate houses or a mobile

camp is to install window type air-conditioning units in every room. This solution immediately appeals to the layman who fails to appreciate, *inter alia*, difference in zoning, the effect of aspect and the cumulative effect of noise when many such units are installed.

There is no doubt that the window type unit has its rightful place in air-conditioning where it makes a valuable contribution and to install it in the right location is to further its prospects considerably whilst failure to realize the limitations can much more easily bring it into distrepute.

Life of Window Type Units

The first point to be considered is the probable life of the unit and figure (2) offers a solution which is based rather arbitarily on the service records of some 600 units in use over a period of eight years under a wide variety of conditions. This statement is in itself an admission of the limitation of a chart which offers a limit of life of ten years since designs have improved considerably over eight years.

In practice it has been found that there are three major factors which affect the life of the units. First, the general conditions of operation and the amount and nature of the handling they receive. Secondly, the ambient air temperature which controls the head pressure and the last, the quality of the electric supply. These three factors have a cumulative effect on unit life.

In laying down the general conditions it is felt that the nomograph covers the worst conditions likely to be encountered which in use reduced the life of the units to three years; this was a consistent figure over some hundred units many of which were virtually in scrap condition after only two seasons and had to be patched up to last a third. At the other end of the scale some units have been installed and have run with no maintenance attributable to this factor for seven years.

The worst conditions were those in which units were installed in temporary huts in deep desert subject to frequent dust storms, camp moves took place about once a month over many miles of rough desert track and winter storage was not available so that the units had to be brought into base at each shut down. This has been set as condition 1. The remainder are as follows:—

2. As for 1 but with infrequent camp moves, say, only one per season.
3. As above but moves largely by train, nevertheless involving quite a lot of handling.
4. Installed within 50 miles of base moved on good roads. Service handling only.
5. Installed in base depot—only moved by hand barrow, no road transport.

The ambient temperature is one which concerns mainly those units which are covered by ASRE

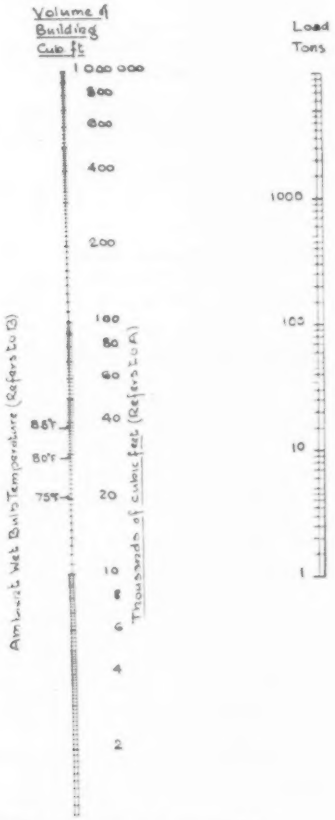
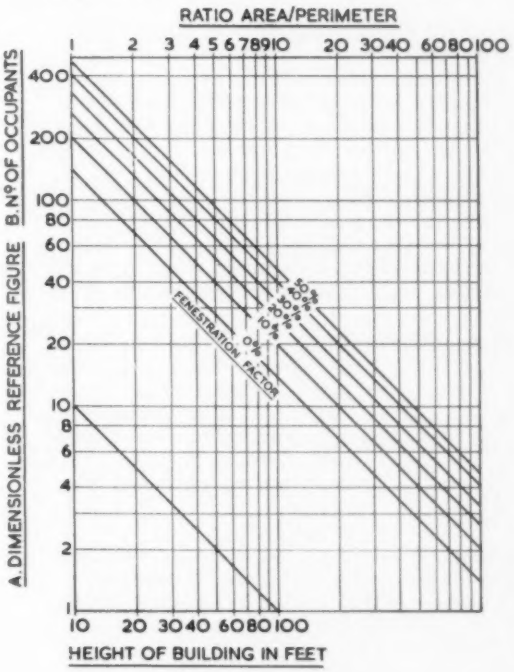


Fig. 1.—Rough estimation of building heat gains.



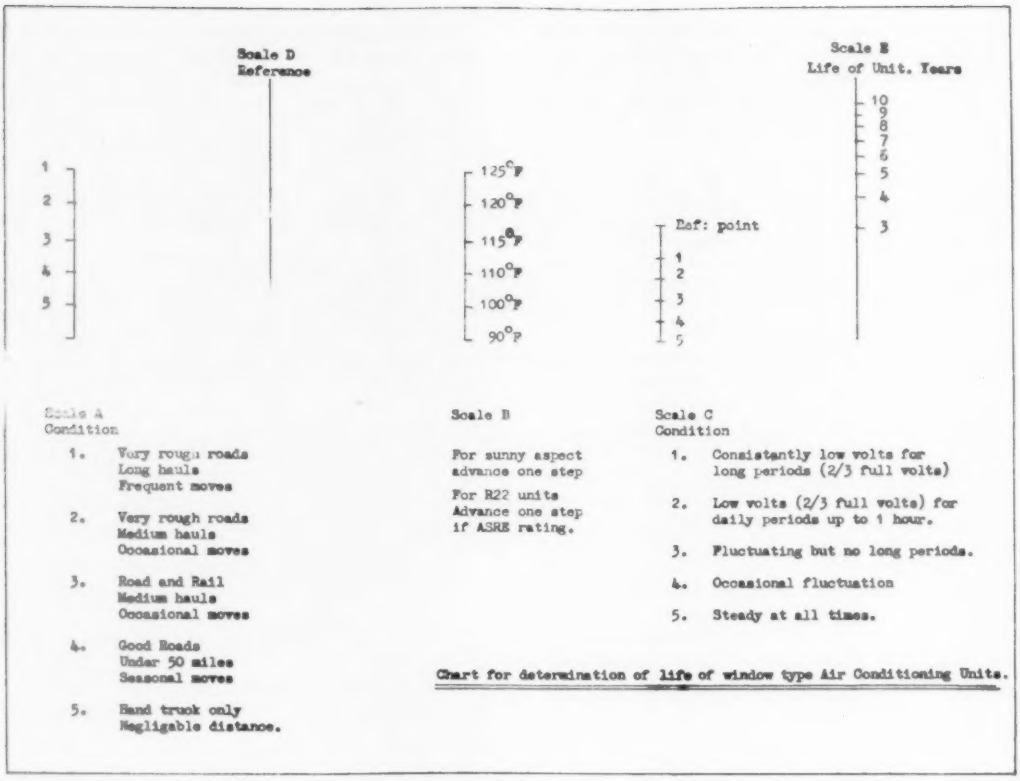


Fig. 2.

ratings and are operated above that limit. Where the units are installed on the sunny side of the building the rating should be advanced by one step. In cases of ASRE rated units advance one step also if they are charged with R-22. If the units have been specifically designed for high ambient temperatures and are operated at the design figure then use 90° F. as the base for scale B.

Fluctuation in voltage can cause no end of trouble particularly where the voltage is down to 65% or less of rated volts for several hours a day and then rises to full volts at night which prevents the use of a transformer.

This is condition 1.

" 2. is where there are only periods of an hour or so per day when voltage is down.

" 3. is fluctuating but without long periods of low voltage.

" 4. is subject to occasional fluctuation.

" 5. is steady.

In the example shown on the chart the units are installed in the base town (condition 4.) operating at an ambient temperature of 115° F. in sunny aspect (advance to 120° F.) and with consistently low voltages. (condition 1.)

Capacity Horsepower Relation of Window Type Units

A second point to be considered in connexion with ASRE rated window type air-conditioning units when used in tropical conditions is the actual rating under the new conditions and the power required. Figure (5) has been prepared to show these for practical purposes as linear relations. This would be incorrect were one unit only being tested but the variation as between manufacturers, and indeed between individual units of the same manufacturer, are greater than the small error involved in simplifying the relationship.

Comparison of Water Chilling Plants

Apart from the necessity to compare different types of systems it is frequently necessary to compare chilled water cooling schemes as between themselves. Making just comparisons is a somewhat tedious job which requires doing thoroughly to be of value and one of the purposes of these articles is to make this analysis simpler.

The proposition put up may consist for example of three decentralized 200-ton plants on the one hand as against a central 600-ton plant on the other.

Probably the first step is to compare the actual costs of the water chilling plants. In making the comparison it is immaterial whether or not such things as cooling towers, water pumps, etc., are included so long as all the proposals are examined on an equal basis.

Figure (4) provides an easy means of making this comparison.

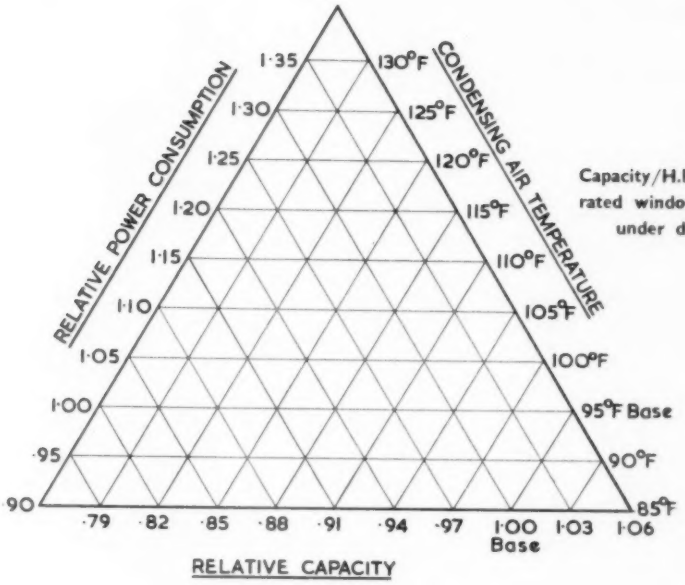


Fig. 3. Capacity/H.P. relation for A.S.R.E.-rated window-type units operating under different conditions.

Commencing with the tonnage quoted in the left-hand (scale A) a line drawn through the contract price for the water chiller (scale B) gives the crude figure for capital cost/ton (scale C) assuming that the plant is evaporating at 40° F. and condensing at 105° F. In the event that other figures are quoted these are located on the right-hand chart and progressed to the left-hand margin (scale E). A line drawn from this point to the crude unit cost (scale C) gives the corrected unit cost (scale D).

Capacity of Chilled Water Mains

Based on this flow of three gpm/ton which gives a temperature rise of 6.7° F. figure (5) provides the capacity of chilled water mains having a pressure loss of 1 lb./sq. in./100 ft. of mains. Since the pressure loss is uniform irrespective of size the total length of one circuit may be judged as a single pipe of that length if the reversed return system is used.

Costs of Chilled Water Mains

If the comparison is to be made as between central-

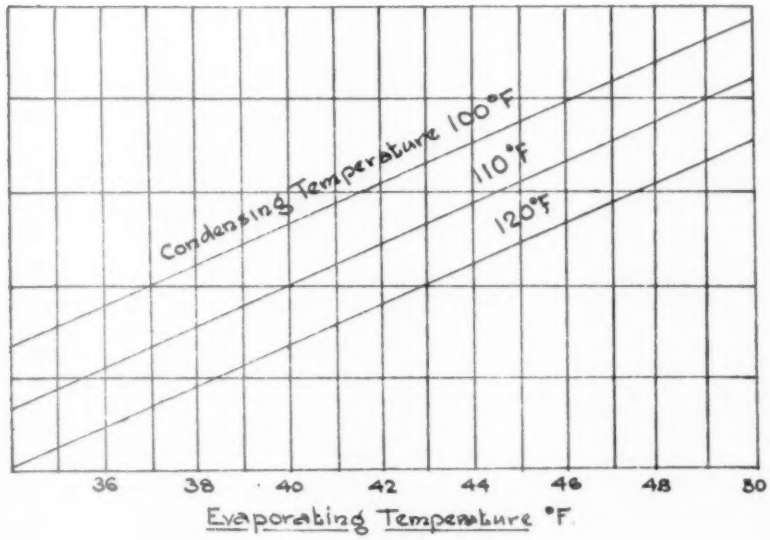


Fig. 4a.—Comparison of water chilling plants.

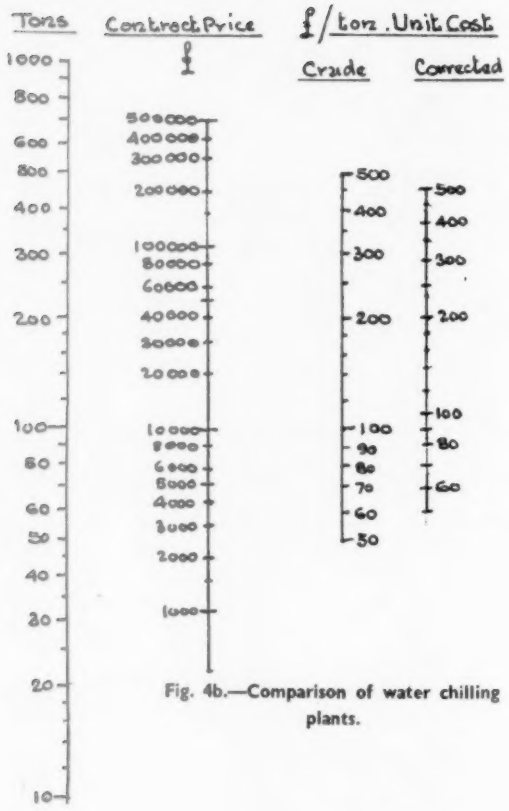


Fig. 4b.—Comparison of water chilling plants.

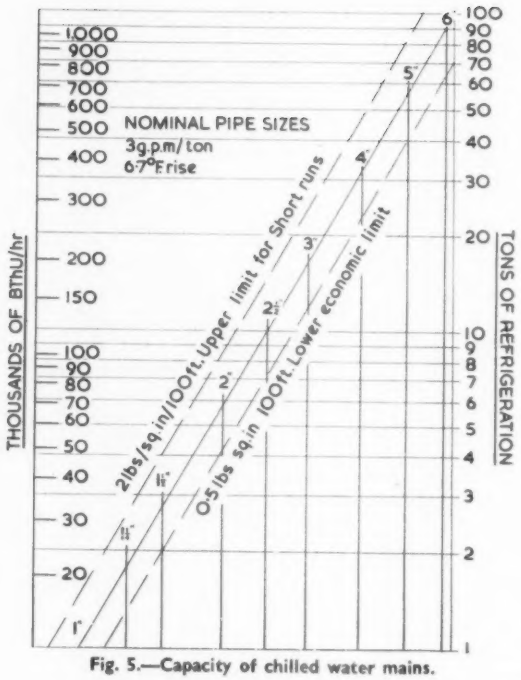


Fig. 5.—Capacity of chilled water mains.

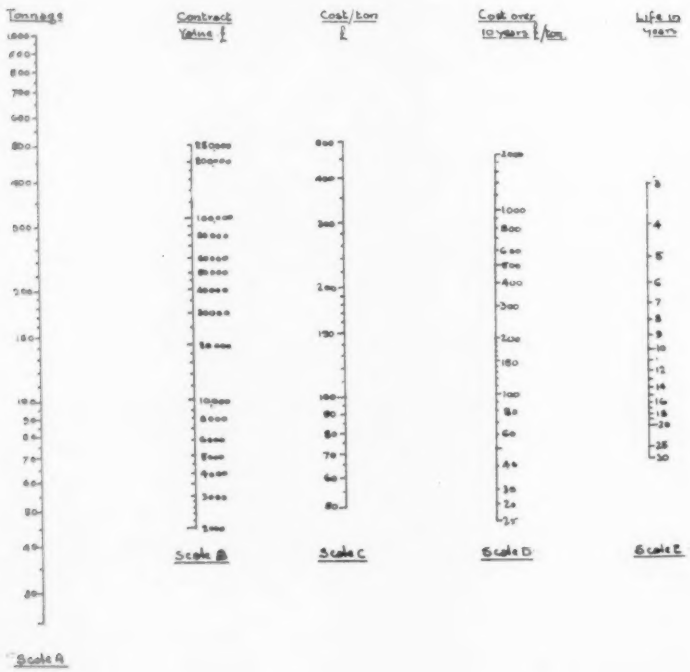


Fig. 6.—Amortization charges for chilled water circulating mains.

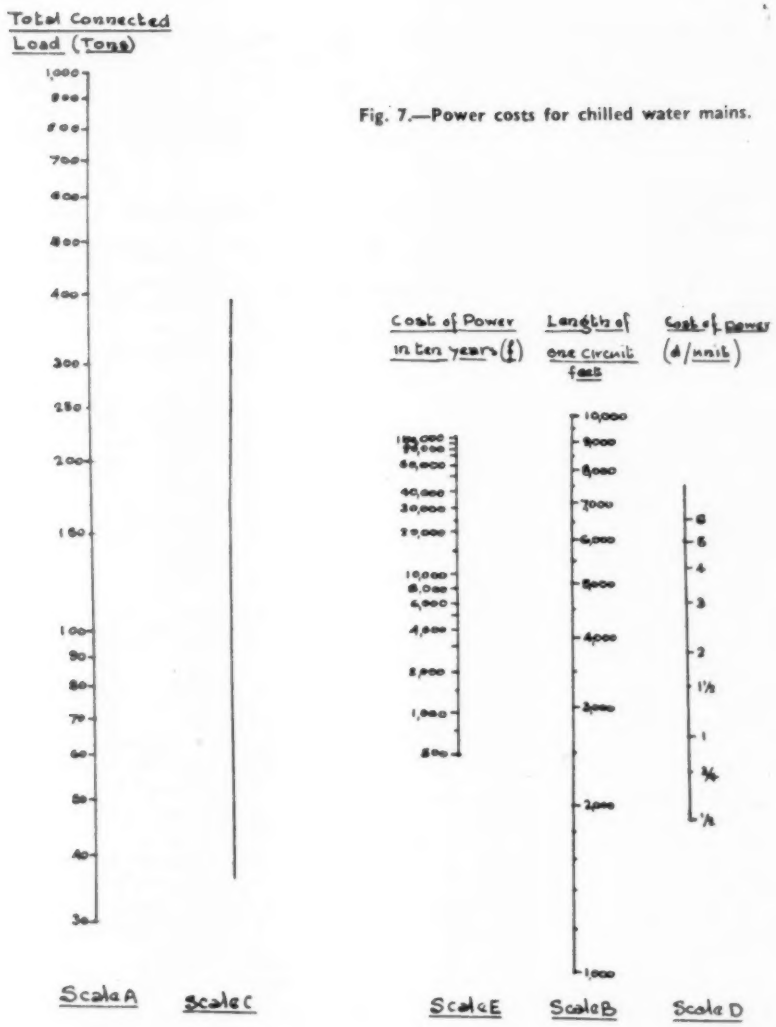


Fig. 7.—Power costs for chilled water mains.

ized and decentralized units then probably the most important consideration is the capital and amortization costs of the chilled water mains. Figure (6) gives the division of total capital cost into unit capital cost per ton.

From scale A to scale B read the result on scale C. From this result is derived the amortization charge by reading on scale D after passing across to scale E for the life of the unit.

A word of explanation is needed here concerning this charge wherever it appears in these articles. It is based on 5% p.a. interest and is given in all cases over a ten year period, that is to say, if items with a life of three years and 20 years are being compared then the chart will include th capital cost of $3\frac{1}{3}$ of the first item or $\frac{1}{2}$ of the second item plus the interest charges on them in both cases.

A large reticulation system will probably contain a multiplicity of circuits each of roughly the same length. From the capital point of view the larger the mains diameter the cheaper the overall cost per ton since both pipe and lagging increase proportionally to the diameter whilst the tonnage handled is proportional to the square of the diameter. On the other hand the length of individual circuit will probably be roughly proportional to the tonnage it handles. Thus it will be seen that whilst large bore long mains may show an advantage in capital cost they will also attract higher power costs for pumping.

In general it is fair to relate the mains heat gains to the tonnage handled rather than the length although there will be wide variations according to the type of soil and insulation.

It is repeated here that the basis for comparison is a reversed return system with a flow main bore a diminishing *pari passu* with an increase in the return main bore and the mains are designed on the basis of a pressure drop of 1 lb./100 ft.

Power Costs for Chilled Water Mains

Figure (7) gives the interrelation between power

costs for pumping, tonnage, the average length of an individual circuit and the mains losses.

The results obtained from figure (7) must not be used to compute the total power costs since they take no account of the resistance to flow through the evaporator and heat exchange surfaces or of differences in level. They do however include the cost of power for offsetting the mains heat gains.

With Special Reference to the

Bulletin of the International Institute of Refrigeration, No. 5 1960

Reviewed by DR. EZER GRIFFITHS, *Hon. President of the I.I.F.*

NEWS

Two main items of interest in this issue of the bulletin are reports on attempts to regularize apprenticeship and vocational training in the refrigeration and air-conditioning industries in Canada, and on the creation of a centre of information on the irradiation of foodstuffs in France.

Following its usual practice, the bulletin gives information concerning current research programmes at various laboratories. Several pages are taken up in the enumeration of topics being studied at the Federal Research Institute, Karlsruhe. Two of these items are experiments on dehydrofreezing of vegetables and colour measurements and development of colour standards of peas.

The Louvain Laboratory reports the creation of a plant capable of attaining a temperature of within 0·01° of absolute zero, and details of research in the several laboratories operated by the Food Investigation Centre are given.

The bulletin contains nearly 200 abstracts in addition to this information. The topics considered in these, divided into 10 main groups, are as follow.

Under thermodynamics : The Proof of Dynamic Similarity Relating to the Calculation of Properties of Refrigerating Agents under Heat Transmission : The Measurement of Thermal Conductivity of Poor Conductors by the Contact Method ; The Heat Flow between Parallel Plates.

Compression Refrigerating equipment : Moisture Meter for Hermetically Sealed Units ; Rotary Compressors ; Economic Aspects of the Application of Turbo-Compressors in Refrigeration Engineering ; When and Where to Use Liquid Suction Heat Interchangers. Equipment : Application of the Peltier Effect for Refrigeration. Insulating Materials : A Guide for Insulation ; Cellular Synthetic Insulating Materials and Styroper Foams as Insulating Materials.

Cold Rooms : Floor and Wall Damage in On-grade Freezers from Frost Build-up—Prevention and Cure ; Investigations on the Freezing of the Ground under the Cold Store at Narrköping ; The Largest Cold Stores in Europe—an account of their Controls and Safety Devices. Air-Conditioning and Heat Pumps : Air-Conditioning, Comfort and Work Done ; Diagrams for Induction Air-Conditioning Plants ; Equipment for Use in the Sahara ; Air-Conditioning for Hospitals.

Transport : Trends of Development in Refrigerated Transport. Water Transport : A Refrigeration System for the Gulf " Trash Fish " Vessels.

Industrial Techniques : The Extraction of Heavy Water ; High Capacity Centrifugal Machines with Cooling. Plants and Products : Study of the Use of Refrigeration for the Storage of Foodstuffs as Compared with other Storage Processes : The Effect of Refrigeration on the Nutrient Value of Foodstuffs ; Accelerated Freeze Drying ; Dehydration by Means of Sublimination ; Resistance of Plants to Very Low Temperatures ; The Effect of the Concentrations of Carbon Dioxide and Oxygen on the Sprouting of Potatoes at 10° C. ; The Timing of Spray Treatments for the Control of Storage Rot of Apples ; Influence of Container and Method of Stacking on Cooling Rate of Apples ; Delayed Controlled Atmosphere Storage ; Irradiation of Apples for Fruit Storage.

Vegetables : Effect of the Wilting and Storage Temperatures on Vitamin C Losses in Fresh Vegetables ; Freezing of Carrots ; Storage of Tomatoes in Controlled Atmospheres and a Continuous Quick Freezing Line for Puréed Vegetables. Meat : Refrigeration of Pork Carcases ; Absorption of Atmospheric Moisture by Freeze-Dried Pork and Fish ; Methods of evaluating Freeze Dried Beef ; Tunnel Freezing of Poultry.

Dairy Products : The Effect of an Oxygen Scavenger Packet, Desiccant Inpackage System on the Stability of Dry Whole Milk and Dry Ice Cream Mix. Fish : The Handling and Chilling of Fish. Other Abstracts deal with : The Effects of the European Common Market on Refrigerating Equipment—The Problem of Meat, Poultry and Eggs.

Included in full in the bulletin is a paper given at the Polish Congress of Refrigeration held in Warsaw in 1960. The Paper is in French and is entitled " Some Aspects of the Development of the Refrigeration industry In The Field of Foodstuffs in the People's Republic of Rumania."

Some of the books recently received in the Library of the Internation Institute of Refrigeration include—Contributions to the Study of the Cooling of Milk on the Farm, a Course on Refrigeration in Italian, and four books relating to Thermodynamics and one on Mechanical Properties of Structural Materials at Low Temperatures.

The new and tenth edition of the National Federation of Cold Storage and Ice Trades' Year Book contains, as usual, informative articles on various aspects of cold storage. In addition there is an index and full details of members and affiliated members of the federation, temperature tables, and a bibliography of books concerned with refrigeration. The growing popularity of this handbook testifies to its quality.

Gas Dehydration by Refrigeration

New type plant in Australia

THE dehydration of town gas before distribution has been practised for many years by a number of gasworks in Australia. A plant of this kind installed in this country was described last year in these columns.

A number of these Australian plants have utilized calcium chloride as the drying agent, but this type has certain disadvantages if atmospheric temperatures are high and fluctuate sharply throughout the 24 hours of the day. Under these conditions a good case can be made for reducing the dew-point of the gas by direct contact with refrigerated water. By this means, dew-points of 36° to 38° F. can be maintained at all times of the year. A number of installations of this type are already in operation in Australia, we learn from W. C. Holmes & Co. Ltd. of Huddersfield.

A disadvantage of this system is that the chilled water is an intermediary between the ammonia in the refrigerator evaporater and the gas, resulting in greater cost of the plant, higher running costs and additional thermal losses. This disadvantage can, however, be minimized if the gas is cooled by direct contact with the coils of the refrigerator evaporator, as the heat abstracted from the gas is then taken directly into the boiling liquid ammonia.

The first plant of this type to be installed in Australia was started up at the East Perth Gasworks in July 1959. This works is operated by the State Electricity Commission of Western Australia. This plant, which was designed by Woodall-Duckham, Australia, in conjunction with W. C. Holmes & Co. Ltd. and the refrigeration engineers, Gordon Brothers Ltd., Australia, handles two independent low-pressure gas streams, each of 4,000,000 c.ft. per day. During the summer, gas may enter the plant at 100° F. saturated, while at other times of the year the gas temperature is about 70° F.

As a limited amount of bore hole water at 70° F. is available, direct contact cooling towers are fitted by which the gas is first cooled to between 85° F. and 90° F. The gas then flows through a gas/gas heat exchanger where it is further cooled to about 75° F. by heat exchange with cold gas leaving the refrigerator section.

The gas is finally cooled to its required dew-point temperature by passing through the final cooler. This is of tunnel form and is fitted with finned cooling coils arranged across the gas stream. These coils are the ammonia evaporator section of the refrigerator, and the gas passing over them is cooled to 35°F.; water vapour is condensed and the gas leaves with a dew-point of 35° F. The dried gas, after passing through the gas/gas heat exchanger, has its temperature raised to about 70° F. at the outlet of the plant.

Condensate, comprising water and a certain amount of light oils, is deposited from the gas in the various cooling vessels; this leaves each vessel through standard seals.

Each gas stream has a single refrigerator, each of which is served by three electric motor driven 16-ton ammonia compressors.

Over-all control of the plant is obtained from the temperature of the gas at the outlet of the final cooler. A controller maintains the ammonia in the evaporator at a pressure equivalent to a temperature of 30°F. The operation of the ammonia compressors is governed by a 6-step controller which stops or starts individual compressors or unloads certain compressor cylinders so that the power demands of the refrigerator follows closely the thermal requirements of the plant. A complete set of recording instruments and the usual refrigerator indicators and alarms are installed.

Following a short settling down period after the initial start-up, the plant has worked steadily ever since. It has proved to be stable in holding the gas dew-points to the required figure and has been surprisingly tolerant of very rapid alterations in the gas volume loading such as occur when a C. W. G. plant is put to work.

In practice there is a slow build-up of ice on the evaporator coils which results in a slow increase in back pressure in the gas stream. This is dealt with by raising the refrigerator evaporator temperature from time to time and resetting it back to normal when the cooled gas temperature begins to rise. The back pressure at the design gas flow is about 3 in. w.g.

New Worthington-Simpson Chairman

As was briefly announced in "M.R." last month, following the retirement of Sir Samuel R. Beale, K.B.E., M.I.MECH.E., Mr. P. B. H. Brown, M.I.MECH.E., M.INST.R., has been appointed chairman, Worthington-Simpson Ltd., the Newark firm of engineers. He was educated at Rugby School and Trinity College, Cambridge, where he took a first class in the Mechanical Sciences Tripos in 1924.

Mr. Brown is also chairman and managing director of L. Sterne & Company, a director of the Glasgow Chamber of Commerce, a member of the management board of the Engineering Employers' Federation, and a member of the Scottish committee of the Council of Industrial Design. He is a past chairman and member of the board of management of Glasgow Royal Mental Hospitals, and was also president of the Scottish Engineering Employers' Association for 1957-58. He was appointed a director of Worthington-Simpson Ltd. in 1949.

Air-Conditioning Plant for Rubber Factory

First installation of its kind in Britain

AN order worth £10,000 for the supply, erection and commissioning of air-conditioning plant for part of the factory of Eschmann Brothers & Walsh Limited at Lancing, has been obtained by Temperature Limited of London, S.W.6.

The installation of this equipment will reduce rejects and lost time at present encountered by providing stable atmospheric conditions free from excessive heat and humidity during the processing of rubber for catheter tubes and similar medical products. It will virtually eliminate problems associated with the coagulation of rubber stock due to humidity, and will incorporate an exhaust system for the 11 ovens used in this part of the factory.

Ecshmann Bros. & Walsh is the first rubber company to install this type of air-conditioning equipment, trials of which are now complete. It will have a capacity of 38 tons refrigeration under normal conditions of use and, owing to the limited space available in the factory, has had to be designed in an especially compact form. The installation is expected to be running in the spring.

"TEDDINGTON" CONFERENCE

Over 30 representatives of many different industries gathered at the Queen's Hotel, Birmingham, recently, for an informal lunch organized by Teddington Refrigeration Controls Limited. This was the first of a series of "whistle-stop" meetings planned by Mr. Stephen Sherlock, sales director of T. R. C.

Photographed at the T.R.C. luncheon (l. to r.) are: Mr. A. E. Haupt (technical and service manager, Bendix House Appliances); Mr. G. Strong (chief development engineer, Wilkins & Mitchell); Mr. S. Sherlock (sales director, Teddington Refrigeration Controls); Mr. P. L. Carnell (sales manager, Parkinson Cowan), and Mr. W. H. Ascott (production and development manager, Rubery Owen & Co. Limited).

Guests included representatives of the gas and oil heater, washing machine, refrigerator and aircraft industries to whom Teddington supply appliance controls. Also present were members of the firm's Birmingham office and the other companies in the Teddington Group.

"Usually, refrigeration people talk to refrigeration people, aircraft people talk to aircraft people, and so on" said Mr. Sherlock. "But what we want is a sharing or pooling of ideas and thoughts between the different industries concerned. I thought it would be a good idea if our clients got together to discuss informally the needs of industry as a whole, especially in the domestic appliances field."

F.B.I. REGISTER

The 33rd edition of the "F.B.I. Register of British Manufacturers" has just appeared. It is published by Kelly's Directories Ltd. and Iliffe & Sons Ltd., price 50s. post free. It is a comprehensive and accurate guide to a substantial cross section of British industry to whose products it is an invaluable source of information for businessmen all over the world.

LORD DUDLEY GORDON

As already reported in these columns, Lord Dudley Gordon retired from J. & E. Hall Ltd. on September 30. His other business activities continue and, of course, he still remains as chairman and director of Hadfields Ltd. His office address is now:— c/o Hadfields Ltd., 25 Berkeley Square, London, W.1.

PRACTICAL ELECTRICIAN'S POCKET BOOK

Now in its 63rd year of publication, "The Practical Electrician's Pocket Book—1961," is available. This useful work, which embodies a number of new and revised sections as well as the usual features, under more than 30 chapter headings, is obtainable from Odhams Press Ltd., 6, Catherine Street, London, W.C.2, price 7s. 6d., post free. New subjects dealt with include automation, automatic oil-burning units, maintenance of motors, transformers, wireman's tools and accessories, and staff location systems.

A well produced brochure, describing the range and applications of plastics materials manufactured by O. & M. Kleemann Ltd., has recently been issued. The company's products in this field include polystyrene moulding powder, polystyrene sheet, profile extrusians in a variety of polymers, polythene, cellulose acebate, and casein.

Refrigerated Transport on Railways

*By T. A. EAMES, M.Sc., F.Inst.P., M.Inst.R.**

MOST of our food is perishable and is liable to a process of deterioration, beginning with loss in appearance and palatability and ending in complete wastage. Of various methods available for combating wastage and conserving quality, the use of refrigeration is of outstanding importance, and is the basis of a large cold storage and frozen food industry.

Refrigeration in alliance with transport enables perishable foods to be distributed to distant markets, and it is incumbent upon transport, as an essential link in the chain of distribution, to provide the special equipment and facilities needed.

The object of this paper is to review present-day practice in refrigerated transport by rail, to indicate the principles involved, and to draw attention to some special factors and problems which need consideration in planning a refrigerated service. In addition to its commercial importance, the subject is a fascinating one where quite diverse sciences meet—biology, chemistry, physics, refrigeration engineering and railway engineering.

In less severe climates special pre-cooling measures may not be so urgently necessary, but, at the very least, good natural ventilation is to be encouraged; a good circulation of cool night air can be a cheap and effective refrigerant for produce still warm from harvesting during a hot day.

This raises another aspect of refrigeration for fresh produce in this country; how far is it worthwhile? The need for refrigeration for frozen goods is obvious, as without it spoilage follows in a comparatively short time, but, in moderate climates, and where the time from harvesting to reaching the final consumer is measured in a few days only, deterioration of many fruits and vegetables is often not intolerably rapid, and the question is then whether any improvement in final quality which may result from the use of refrigeration results in appropriate financial returns. The present pattern of refrigerated traffic emphasizes this question. Here refrigerated transport is almost entirely concerned with frozen traffic; in America and Europe fresh traffic still predominates.

Refrigeration is most likely to meet with success where spoilage is most rapid, and where the financial value of the produce offers most inducement to paying for the additional protection. Fresh strawberries and raspberries fall into this category, and experiments using containers refrigerated with dry-ice (solid carbon dioxide) began in 1934.

In more recent years a comprehensive investigation into the distribution of strawberries and raspberries was undertaken by a Government inter-departmental committee under the chairmanship of Mr. W. H. Smith of the Ditton Laboratory with British Railways co-operating. Laboratory scale experiments and also American experience had suggested that, in addition to precooling, an atmosphere containing 20 to 30 per cent. carbon dioxide was beneficial, and this strongly suggested that the solid carbon dioxide method of rail transport owed what success it had enjoyed as much to the carbon dioxide gas as to the modest amount of cooling obtained.

Fresh fish is traffic which has many peculiarities of its own, and has been the subject of recent studies jointly by the D.S.I.R. and the railways.

A survey has been made of actual temperatures of fish at different stages of distribution, and one feature of significant interest to rail transport is that a substantial warming up can take place between the time the fish is unloaded at the port and the time it is re-packed in the familiar fish boxes for rail distribution.

As to methods of measuring heat leak coefficients, there exists, as far as European railways are concerned, code UIC 574 O which lays down a procedure which is widely used. The vehicle is placed in a constant temperature room and a steady known electrical heat input is used to raise its interior temperature.

METHODS OF REFRIGERATION

Refrigeration must be sufficient to absorb the heat leak calculated in the manner previously indicated together with any additional load cooling requirements. First, there must be sufficient rate of heat removal in B.t.u. per hour, and this will be dependent upon the temperature and area of the cooling surfaces and the rate of air circulation. Secondly, the total cooling capacity must be such as to maintain this rate for the normal journey time.

It is worthwhile drawing attention to these primary requirements because it is too often assumed that mechanical refrigeration must in some way represent a technical advance over the use of water ice, but this is not necessarily so at all and, provided the basic performance figures are met, the choice of a refrigeration system can be made on other grounds, such as cost, weight and size of the equipment, the possibility of control, flexibility in meeting different service conditions, and reliability.

Water Ice

Water ice is still the commonest form of refrigeration in Europe and America. The fact that it still holds its own is a reflection of the importance of the fresh fruit and vegetable traffic.

Modern water ice refrigeration practice is exemplified in the Interfrigo UIC O.R.E. Type 1 van.

Eutectic Solutions

The Dole plate is a proprietary form of eutectic solution device. It consists of a shallow tank or hollow plate containing the solution, and also incorporating piping which can be connected to a ground-based refrigerating machine and used to freeze the solution. A number of B.R. AF type containers are fitted with this arrangement.

*British Railways Research Department (Engineering Division), Derby. A paper read before the Institution of Locomotive Engineers on November 15, 1960.

For best results a bunker under the roof is used in which the dry-ice rests on a metal plate, the size of which can be designed to give a definite and almost constant rate of heat absorption. In terms of equipment required dry-ice is the simplest of all the refrigeration systems.

Mechanical Refrigeration

Mechanical refrigeration for rail transport has developed to any considerable extent only in the United States, and even there the number of vans fitted is still below the number of water ice vans. Figures for 1956 in the United States were 2,366 mechanical and about 125,000 water ice refrigerator vans, whereas in the European countries covered by Interfrigo and associated companies the corresponding figures were 9 and 13,193 in 1959.

A jacketed form of construction is commonly adopted for the van interior ; this consists of a sheet-metal lining, leaving a cold air circulating space between it and the vehicle wall proper, which ensures that the frozen load will be completely enclosed within a low temperature jacket. Diesel-electric drive is at present favoured on the grounds of better reliability. Lack of complete reliability is the chief problem which faces operators of mechanically refrigerated vans where the plant must work unattended for much of its time. In addition to routine maintenance between journeys, it is found at present that about one unit in five requires some attention during a two weeks trans-continental journey. Although most of these faults may be of a minor charactor, their early detection and correction may be vital since, when failure does occur, there is an immediate complete stoppage of refrigeration. This is a real source of weakness as compared with refrigeration by water ice or dry-ice.

Absorption Machines

An alternative to the compressor machine is the ammonia absorption refrigerator, in which heat is absorbed in the cooling coils by the evaporation of ammonia, which is then chemically absorbed into water or a solid absorbent such as calcium chloride. The ammonia is regenerated by heating. A machine working on this principle fitted to a railway van has been fully described elsewhere. The point it is desired to emphasize here is that it was a machine specifically designed with railway requirements in mind and not merely an attempt to attach some existing plant to a railway vehicle. The source of energy for working the machine is heat rather than mechanical drive, and in this case normal train steam supply was used. The operating cycle of the machine was reduced to a basic minimum for simplicity, and the only mechanical moving parts consisted of valves to control the input of steam and of cooling water, so that the maintenance required was of the simplest. To solve the difficulty of holdover to cover periods when heat was not available, a generous reserve of ammonia was included in the evaporator. It shares the advantages of mechanical refrigeration, that is to say continuous operation and flexibility of control, but is without most of the mechanical complications, and although, as far as is known, this is the only example of applying the absorption machine principle to railway refrigeration, it would seem worth further serious consideration.

Thermoelectric Cooling

Thermoelectric cooling makes use of the reverse thermoelectric effect named after Peltier.

Power for its operation is from a low voltage d.c. supply, and the auxiliary equipment, and maintenance required for this, is approximately within the ambit of train lighting battery practice.

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TWO NEW SMEDLEY VEHICLES

Two new Guy Warrior refrigerated trailer units, for the transport of frozen foods, are now operating from the Dundee and Blairgowrie factories of Smedley's Ltd. Each vehicle operates a weekly service to the south carrying a 10-ton payload in both directions, with a gross vehicle weight of about 20 tons. Approximate weekly mileage is 1,100.

Frozen foods are generally carried on the Southward journey and canned foods form the cargo on the way back. Working areas for deliveries are mainly Smedley Depots at Wisbech, Spalding, Faversham and Whyteleafe.

One-Piece Moulding for Refrigerated Bodywork

THE development of new techniques in the construction of vehicle bodies since the discovery of the now widely used range of versatile plastics materials available to engineers, has been the foundation of a branch of the transport industry which can now produce a working unit with qualities which would have been far beyond the wildest dreams of manufacturers 10 years ago.

Plastics materials, not being susceptible to the same enemies as timber and steel—rot, rust and corrosion—save costs and maintenance, and, important in transport, they provide a considerable saving in weight. Plastics have been used in a number of different ways in conjunction with conventional materials, but it is only recently that a company in the body-building field, Mickleover Transport Ltd., Park Royal, London, N.W.10, has developed a body which is in the form of a one-piece moulding in glass fibre. Examples of mouldings produced by this company attracted considerable interest at the recent Commercial Motor Show in London.

In addition to saving in weight, and providing good strength and durability, mouldings in plastic have their own inherent insulating qualities which provide a ready-made answer to many of the problems associated with building in conventional materials.

In the production of these bodies, use is made of a rotatable mould. This is of such a size and shape as is appropriate to the body design, and individual variations in dimensions can be made so that the flexibility required to meet different specifications is the same as with conventional building methods.

Resin is first applied in the mould and is colour impregnated to the operator's choice. To this a reinforcing agent is added, followed by the incorporation of a foamed plastics core. Finally, the inner face is bonded to the centre core, thus producing the "sandwich" construction. When the body is removed from the mould it is an integral one-piece moulding of great rigidity. It is also frameless—the construction combining both the functions of framework and cladding.

When a one-piece moulded body is made with a sufficient wall thickness to afford a K factor appropriate to the transport of low-temperature traffics, the comparison with a conventionally built body of the same thermal efficiency is immensely favourable. Not only is its construction no more complex than that of any other one-piece moulded body (and therefore far less so than a conventional insulated structure), it is also lighter.

In addition, for a given thermal efficiency, the wall thickness of a one-piece

Two examples of refrigerated containers in one-piece mouldings.

moulded body is much less than that of a conventional body with insulating medium between inner and outer panelling. Together with the saving in weight, this means that with legal and other limitations imposed upon outside dimensions, a one-piece moulded body for low-temperature traffics gives the operator greater payload space.

The accompanying illustrations show an insulated lift container and a vehicle body. The container, which has a payload capacity of 5 tons, is constructed to be handled by crane or fork-lift truck. Its dimensions are: length, 11 ft. 9 in.; width, 7 ft. 4 in.; height, 8 ft.

Sandwich construction of the container is 4 in. thick at the sides and 3 in. thick at the top and floor. The base is a steel fabrication with two longitudinals and four cross-members of top-hat section, and the underside of the moulding has indentations corresponding to the contours of the cross-members. All lifting stresses, whether imposed by crane or fork-lift truck are absorbed by the steel base. The forks of a lifting truck may be inserted in the innermost cross-members so that the whole container can be raised and handled as, in effect, a pallet-load.

Provision is made in the usual way for lifting by crane there being two contoured shoulders moulded into the roof section for this purpose and lifting bars running from the sub-frame with eyes at roof level. The moulded shoulders are supplemented by two other lateral roof shoulder mouldings and the outer ends of these four ridges are stepped in alignment with the spacing of the sub-frame longitudinals Thus when one container is laid on another (they can be stacked three high when empty), the longitudinals of the upper nest with the roof of the lower. The container has a single aperture at the rear 6 ft. 3¾ in. high by 6 ft. wide, with a pair of one-piece moulded doors which close against hermetic seals.

The 1,030 c.ft. body on the Thames Trader chassis illustrated, is intended for the long-distance transport of frozen food and the forced draught refrigeration equipment was installed by the operators, Pullrode Ltd. The main body compartment was moulded as a unit and the sandwich construction of the side, front bulkhead, roof and floor is 3 in. thick. This provides adequate insulation for the goods the vehicle will carry.

Refrigeration plant is carried in a Luton head consisting of a floor cantilevered from the bulkhead, and a front which is hinged across the roofline to provide access to the equipment. There are louvres in the front for the intake of air. The cooler is inside the main body in front of a false bulkhead, and there are two reinforced plastics ducts running along the top of the body at cant-rail level to convey cold air to the rear, two fans providing the draught for this purpose.

In common with all Mickleover one-piece moulded productions, the floor is especially treated to resist abrasion and give exceptional durability. At the rear there are two doors of sandwich construction. These open through 270° and close against an hermetic seal. For the mounting of the body to the 15 ft. 2 in. wheelbase chassis, runners are bonded to the underside and these are attached to the frame by mild steel brackets and coupling plates.

Less refrigeration equipment, the body weighs 1 ton 6 cwt., a remarkably low figure for a construction of this type and size. The interior dimensions are: length, 18 ft. 11 in.; width 7 ft. 5¼ in.; height at centre 7 ft. 5 in. The loading height unladen is 4 ft. 5 in. The vehicle complete is 27 ft. 1¼ in. long, 8 ft. wide and 12 ft. 1 in. high overall.

MEAT PRODUCTS CARRIAGE

Two refrigerated bodies on Thames Trader chassis have recently been delivered to T. Walls & Sons (Meat Pies & Sausages) Ltd. by Mann Egerton & Co. Ltd. The vehicles are designed for carrying meat products at temperatures around 30° F. Forced convection refrigeration equipment is fitted. They are equipped with double roller tracks so that pallets can be easily loaded and off-loaded.

A booklet describing the properties of silicones manufactured by the Nobel Division of I.C.I. Ltd. has recently been issued. Silicones, states the booklet, are a family of chemical compounds based on silicon and possessing a unique combination of properties including chemical and physical stability, resistance to extremes of temperature, excellent electrical insulation characteristics, exceptional water repellency and freedom from sticking. They are available from the Nobel Division of I.C.I. in a range of fluids, rubbers, rubber gums and pastes, resins, emulsions, greases and miscellaneous products, designed to meet many requirements.

Highly Efficient Truck Body

A large-capacity insulated and refrigerated body was recently placed into use for the transport of Bird's Eye Foods Limited sponges and other frozen foods. The body which is of 1,080 c.ft. capacity is built on a Dodge 8-ton long-wheelbase diesel chassis, and the vehicle is used principally for trunking work between the North of England and the Bird's Eye Foods factory at Eastbourne.

Cooling is by a Thermo King forced air convection unit which, on this and other similar vehicles, has provided a highly successful and economical method of holding sub zero temperatures. J. H. Sparshatt & Sons Ltd. of Portsmouth have designed and built this direct insulated body utilizing their patent frameless stressed panel design, which offers an exceptionally high thermal efficiency.

Tests were carried out recently under most stringent conditions by Bird's Eye Foods Limited and subsidiary companies on basically similar bodies which were to be exported to one of their companies in Germany, during which thermal efficiencies of 78 per cent were obtained.

It is claimed that the advanced techniques in insulated body design developed by Sparshatt's have resulted in thermal efficiencies that cannot be matched at the moment by any other refrigerated body available in this country or on the Continent. It would seem that this claim has been proved repeatedly under practical operating conditions with the many hundreds of refrigerated vans incorporating the Sparshatt patent method of frameless construction in use with leading frozen-food manufacturers.

NEW "DANMARK" VAN

BUILT for Danish Frosted Foods Ltd., by Danish Bacon Co. (Industries) Ltd., Selby, this refrigerated vehicle is mounted on a five-ton, T.K., Bedford chassis.

The van body is coach built and has an air-lock at the rear. The entrance to the refrigerated compartment is by 6-in.-thick rebated and double-sealed insulated door. Further protection from loss of temperature is provided by the inclusion of batwing automatic closing doors immediately inside the entrance to the refrigerated chamber.

The payload compartment of 350 c.ft. is insulated with polystyrene vapour sealed with Kingsnorth no. 25, the whole being enclosed in polythene sheeting, 500 G.

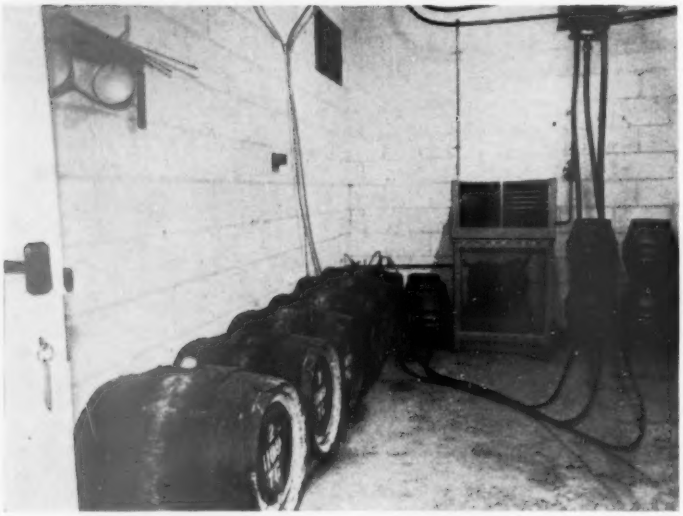
The fibre-glass roof, incorporating the roof ribs, is fabricated and fitted as one unit mould n g. Also the floor of the refrigerated compartment and the air-lock are prefabricated in fibre-glass, radiused to the side panelling, which is in aluminium.

Prestcold electrically driven compressor unit, model AS 200 L serves six Winget hold over plates, two of which are mounted on the bulkhead and four suspended from the roof.

A warning system incorporating the vehicle horn in circuit with a flashing light mounted on the cab and operated from a switch mounted in the refrigerated compartment is installed to prevent the driver being trapped in the vehicle, in the event of trouble with the door fastenings.

Externally the vehicle is designed to display the brand image used extensively in the marketing of the D. Danmark products. Predominantly white, blue, green and red are included to follow the design used throughout the produce cartons.

Also included are symbolic stars, representing ice crystals, and the brand "Danmark" in red.



CELLAR COOLING

(continued from page 44)

The cellar of the newly reopened "Crown" Hotel, showing the "Temkon" beer cellar cooler, installed to ensure that beer is served at constant, palatable temperature.

TWO-STAGE ROTARY BOOSTER PACKAGE

A TWO-STAGE rotary booster package with inter-stage liquid and gas cooler, automatic lubrication system, completely piped, insulated and mounted on a common structural steel base, has recently been introduced by Freezing Equipment Sales Inc., of York, Pennsylvania, and will be available for export to the U.K. Jacket cooling in the rotary is provided by an oil system with a refrigerant-controlled cooler. No jacket water is necessary to operate the two-stage system. The package is especially adapted for low temperature storages or freezing tunnels where engine room space is at a premium. Package design may allow installation in processing area and eliminate need for additional building space to house refrigeration equipment.

Rotary booster packages are designed for low temperature refrigeration applications, such as frozen foods and ice cream storage rooms, large supermarkets and wholesale distributors, frozen food processing, low temperature test chambers.

The rotary booster package consists of the following : a low-stage FES-Fuller rotary booster model F25 operating at 1,500 r.p.m. Rotary includes suction strainer, suction and discharge stop valves, jacket oil cooling system, suction and discharge pressure controls, discharge temperature limit control, v-belt drive with 20-h.p. 220/440/3/60-a.c. motor. A high-stage reciprocating compressor $2\frac{5}{8}$ by $2\frac{1}{4}$—six-cylinder operates at 1,750 r.p.m. Reciprocating compressor includes suction and discharge stop valves, suction strainer, high- and low-pressure cut-outs, oil pressure differential switch, shaft coupling and 20-h.p. 220/440/3/60-a.c. motor. Electrical starting equipment and wiring are not included.

Model F256 package has the following over-all dimensions : length 6 ft., width 3 ft. 3 in., height 5 ft. Rating with refrigerant—12 at 105° F. condensing temperature is –30° F. evaporative temperature 12·0 tons ; –50° F. evaporative temperature 6·8 tons, and –70° F. evaporative temperature 3·6 tons.

Christmas shoppers were stopped dead in their tracks when the ferocious looking gentleman, pictured above, was spotted striding into the London showrooms of Lec Refrigeration Ltd. Even the showroom staff were jolted out of their usual savoir-faire. But it transpired that the strange visitor merely wanted somewhere to park his catch while he inspected the "lights." Needless to say, Lec were only too pleased to help.

SHOP REFRIGERATION NEWS

A Cross-section of Recent Installations

By Our Special Correspondent

FROM DISCOUNT HOUSE TO PATISSERIE

DISCOUNT houses are the latest adoption and adaptation of American self-service merchandising to be introduced in this country. These are giant price-cutting establishments which, although operating completely on help-yourself principles, are different from normal supermarkets because a larger proportion of space is given up to other than food products. And they differ from department stores in that their range of merchandise is limited to popular quick-selling lines.

One of the first discount houses to be opened in this country was Supa-Save at Southend-on-Sea, now occupying the building that was formerly the Essoldo cinema. This 10,500-sq. ft. store includes a food department operated by Savon Foods Ltd., a new subsidiary company of Green's Stores (Ilford) Ltd. This includes 60 linear feet of refrigerated display in Prestcold cabinets along the left-hand wall. These cabinets, manufactured by Bedford Refrigeration Co. Ltd., and installed by Refrigeration (East Anglia) Ltd., of Bury St. Edmunds are given up to bacon, pies, sausages, poultry, and fresh meat, and behind them are the preparation rooms.

Another example of a self-service store in which almost everything sold is offered at a reduced price is the Discount Supermarket at Hemel Hempstead, Herts. (One of the exceptions is frozen foods.)

Here the installation of refrigerated display equipment was carried out by Howards Refrigeration Ltd. of Luton, Beds. One Frigidaire cabinet is given up to fresh meat supplied ready-wrapped by a local butcher, and, adjoining this, are two triple-tiered, 6-ft.-high Forum cabinets.

This Frigidaire development is notable in its singular suitability for self-service. From a glance at the left-hand side of the accompanying close-up view of the three cabinets just mentioned, it will be seen that it brings refrigerated display up to eye level, and that the non-refrigerated display on top gives the Forum cabinets, in effect, the same height as the adjoining wall fittings. Each of the three display tiers is fitted with white plastic-dipped steel wire shelves and the two upper tiers are faced with low screens of clear glass.

A cabinet of this same three-decker Forum type is also installed in Fox Farm Stores at Sanderstead, Surrey. This, contrary to the impression given by its name, is a relatively small shop, having a selling area of only 600 sq. ft. This cabinet as well as the one for frozen foods adjoining a gondola in the centre of the shop, was installed by Trembath & Co., Ltd., Frigidaire distributors for this district.

At Poole, Dorset, there is a self-service shop known as the Dale Valley Supermarket owned by a master-builder by whom it was planned and constructed. Here the refrigerated display equipment comprises three joined-up Frigidaire Selmore cabinets : one for provisions, one for ready-wrapped meat and one for quick-frozen foods. This store has also two coldrooms, one of 650 c.ft. capacity for provisions and another of 850 c.ft. for meat. There is also a conservator for ice-cream storage. The complete installation was carried out by Aish & Co. Ltd., Bournemouth.

Some self-service shops trade under the term supermarkets when they are neither by size nor character entitled to be thus described. The accepted qualification for use of that term is that a self-service store must have an area of not less than 2,000 sq. ft., and must sell a proportion of merchandise other than and in addition to foods.

So, strictly speaking, this store, since it has a selling area of only 1,500 sq. ft., is not a supermarket.

Above: Another example of three-tier refrigerated display, with a Frigidaire Forum cabinet, this time in a small self-service shop. This cabinet in the corner and also the one for frozen foods in the centre of the shop were installed by Trembath & Co. Ltd.

Right: In the self-service store of Discount Supermarket Ltd., Hemel Hempstead, dairy produce and cooked foods are displayed in two 6-ft. high Frigidaire Forum cases installed by Howards Refrigeration Ltd.

Below: The three joined-up Selmore cabinets in the Dale Valley Supermarket at Poole. Installed by Aish & Co., Ltd., Bournemouth.

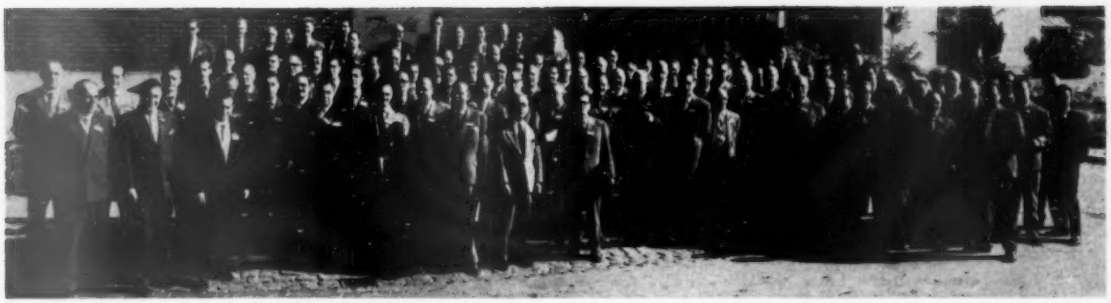
Now I want to look at another phase of refrigerated display: the shop window. At present there are far more refrigerated window slabs or beds or bases to be seen in butchers' shops than in those of the fishmongers. That is understandable because, whereas butchers have gone over wholeheartedly to the glass-fronted shop, there are still a great many fishmongers with open-fronted premises. And a large proportion of these unenclosed shops still have slabs that are neither covered not refrigerated.

The increasing sales of quick-frozen fish by grocers, greengrocers, and supermarkets must surely have the effect of making the fishmonger give more attention to the hygienic presentation of wet and smoked fish.

Meanwhile, appreciation of the possibilities of refrigerated display is, in extremely rare instances, becoming evident in another trade handling still more perishable products: the pastrycook's.

Pioneering in this respect are Sheratons Patisseries Ltd. In this company's shop at Marylebone High Street in the west end of London. Brett Daniels Ltd., Frigidaire distributors in this area, have installed a refrigerated display base in the window, which is maintained at a temperature of 40° to 42° F., by means of a fan-assisted cooling coil housed beneath the display area.

(continued on page 87)



Members at Danfoss 7th International Refrigeration Conference.

100 Attend Danfoss International Conference

LEADING experts from 18 different countries all over the world, were the guests of Danfoss, Nordborg, Denmark, between September 25 and 30, when they attended the company's Seventh International Refrigeration Conference. Through conducted tours and discussions with Danfoss technicians, delegates had an opportunity of acquiring a more thorough knowledge of the design and functioning of the individual apparatuses produced by the firm, and in the course of the conference excursions were arranged to different refrigeration plants in Denmark where Danfoss automatic controls are in use. A number of lectures were held where special conditions within the field of refrigeration were discussed.

In a paper entitled " Why, when and how to defrost " Prof. Sv. Aa. Andersen, of the Technical University of Denmark, began by drawing attention to the well-known fact that when atmospheric air is cooled to a certain temperature—dependent on its content of moisture, they could see this moisture separate either as water, in cases where the dew-point temperature was above 0° C., or as snow or ice, when the temperature was below zero.

" If air passes over a cooling plate or coil with a surface temperature which is lower than the dew-point, the separated moisture will be deposited as condensation water or as snow or ice. When the question is of water, this will cause no change in the generation of cold, for water will run off again. On the other hand, snow and ice will remain, and the frosting will increase in the course of time.

" This will affect the generation of cold," continued Prof. Andersen, and they had now come to the question of why to defrost.

It was well known that heat could be transferred in four different ways from the air which by its own convection or by forced circulation flowed past a cooled plate or a cooled pipe.

These four ways were : heat transmission by conduction, by convection, by diffusion, and by radiation, and the quantity of heat transferred per hour may be expressed in the equation :—

$$Q = (\Sigma a\mu \times F) \times ({}^{\prime}u \div t_o)$$

Here $\Sigma a\mu$ was considered as consisting of a total of three heat transmission coefficients, one of which was equal to the coefficient for the latent heat, which was to say the part of the heat transmitted by diffusion of moisture from the air to the surface."

" The greater this coefficient becomes in proportion to the other terms in $\Sigma a\mu$, the quicker will frosting be accumulated on the surface, and this frosting possesses a resistance to thermal conductivity dependent on the consistency of the frosting.

" In very cold rooms or rooms with comparatively low relative humidity a slight layer of snow crystals with many tiny air spaces between them will be formed in the beginning. These latter insulate more than a layer of ice formed from the beginning in a room with higher relative humidity. However. owing to penetrating moisture the said air spaces will gradually be filled by ice, and consequently both the specific weight and the thermal conductivity will increase."

In the treatment of the question of when such defrosting should take place the lecturer said, amongst other things : " Defrosting should be performed when the coefficient of heat conduction K has fallen so far below its initial value that the relative humidity, and supposedly also the temperature, can no longer be kept within the prescribed limits. The conditions are rather complicated, so that one must to a great extent build on practical experiences. Certain orientating calculations can be made, partly based on experiments ; but the calculations are so complicated that an exposition of them will be too comprehensive in this lecture."

The remaining part of the lecture dealt with examples of the most important and most frequently applied defrosting.

Speaking on " The application and functioning of various danfoss apparatuses elucidated by examples from practical experience," Chr. Matthiesen, technical director of Danfoss, gave a long series of examples

of automatically controlled plants where Danfoss automatic contro s were in use.

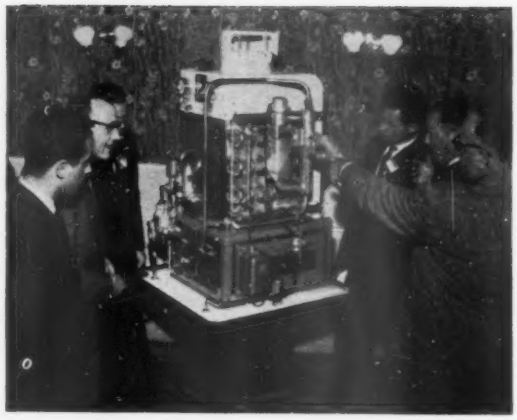
" The purpose of automation of a refrigeration plant is to make the operation of the plant independent of manual operation in such a way that the desired states in the individual parts of the plant w ll be observed irrespective of the volume and character of the load," said Mr. Matthiesen in his introduction. " For this purpose Danfoss makes a large number of different apparatuses, which may roughly be divided into primary and secondary regulation devices. By primary automatic controls is understood apparatuses by means of which it is possible to obtain an automation in the simplest form, namely automatic injection of the refrigerant. By adding secondary automatic controls a further and more specified automation can be achieved."

In the course of his exposition of the primary automatic controls the lecturer ca led special attention to the thermostatically controlled expansion valve as an apparatus which had greatly contributed to the wide application of automatic refrigeration plants in the course of a comparatively short number of years.

The application and functioning of this type of valve was accounted for in detail, and Mr. Matthiesen said, amongst other things, " In connexion with thermovalves with external and internal equalization

A special part of the conference programme was a conducted tour of the production departments of the firm during which the members had an opportunity of following the manufacturing of the individual apparatuses step by step. Here is the thermostatic evaporator control type 50 during a working test before it is handed on to the storage department.

of pressure liquid distributors are often used, and in this relation it may be pointed out that Danfoss has now commenced the production of small thermovalves equipped with external equalization of pressure, so that also valves with capacities from about 1,000 kcal. to about 4,500 kcal. can now be used in connexion with liquid distributors. The valve, whose code letters are TVE, and which can be applied in connexion with the new distributor type 69, has been included in our manufacturing programme in the summer of 1960. In this way Danfoss is able to cover the market for thermostatically controlled expansion valves with distributors from the smallest capacities up to about 200,000 kcal."



Stands which in an easy way illustrated the functioning of various Danfoss controls aroused great attention. Here is Mr. Matthieson, technical director at Danfoss (number 2 from left), at a demonstration of Danfoss level control type 38E.

In his treatment of secondary automatic controls, Mr. Matthiesen entered into the question of the condenser of the refrigeration compressor and its automatic regulation.

" At Danfoss the water valve is made in many different designs and types," said Mr. Matthiesen, " and we can present a water valve designed according to the most modern principles."

R.S.A. NEWS

DESCRIBING applications of industrial refrigeration, Mr. J. H. Bruce addressed the president, Mr. Douglas, and members at the R.S.A. November meeting.

Commencing with deep freezing, he reminded them that there are three stages. Removal of heat from the produce to freezing point—this point varies according to the type of produce ; removal of the latent heat, and the removal of heat to the predetermined freezing temperature. Of the three, the removal of latent heat is the most important.

This naturally led to a discussion of the difference between slow and fast freezing and the effect each has on the product.

Briefly, the difference is in the size of ice crystals formed in the tissues of the product. With fast freezing, these ice crystals, formed from the water content in the produce, are small. With slow freezing, they are large. In fact, they are large enough to rupture the cellular structure causing loss of both juices and flavour when the product is thawed. This is so, irrespective of the type of produce be it meat, vegetables, poultry or fish.

This ice crystal formation zone was seen on charts that gave temperatures, time and thickness of fish cuts. It is appreciated that the structure of fish renders it susceptible to rupture by the slow freezing process.

Continuing the talk, slides illustrated dairy applications that included the ice bank storage plant designed for the small dairyman, for the manufacture of flake ice ; used in the fish and poultry industries to precool and preserve the goods ; and brine precooling baths for "Cellophane" wrapped turkeys. The latter application had been dealt with in more detail last session.

While the slides showed banks of blower coils in the cold stores holding the turkeys, other slides showed the use of air ducts for cheese-ageing rooms. These ducts are found suitable where close humidity control is needed to prevent drying out and cracking of the cheeses.

Another interesting application was the glazing bath for meats and fish after deep freezing. The writer had not seen this type of application for some time and it is interesting to hear again of this method being used to prevent dehydration and loss of weight—the latter being loss of profit. It was stated that it is not unusual for the produce to receive additional glazing when subject to long storage.

The Jackstone plate freezer was shown and members told of the new type of metallic flexible coupling now used between the plates.

Of especial interest were slides showing that finned evaporators are not confined to the higher temperature stores. A 400,000-c.ft. low-temperature store was shown with finned overhead cooling grids. The fins, allowing shorter lengths of pipe to be used, permit the grids to hang over the gangways. Defrosting can be carried out without damage to the goods. Temperatures as low as –20° F. can be achieved.

Among the slides was one of a poultry store with vertical sliding doors at each end and conveyor rails that slid to the openings when the doors were opened. The doors give a saving of space and the general design enables the produce to be drawn out as required according to the order placed in the store. It was seen that there is an all-round saving of space with convenience. After the talk, the chairman, Commander Ranken, announced that Mr. J. H. Bruce had been intimately connected with the design of this type of store.

If such is needed, this was further proof that the quality of speakers is high and members at question time have the benefit of first-hand knowledge.

Also shown were slides of both can and block-ice plants. A 12-can batch in the grid with lifting tackle ready for dropping in the brine tank was seen, but of greater interest was the block-ice maker. Needing less room, this plant freezes by direct expansion. The cans, integral with the plant, are mounted above the floor and harvesting is carried out by mechanically easing the frozen blocks from the bottom of the cans after thawing free from the can sides.

Slides were seen of old-type vertical, Vee-bloc and centrifugal compressors that clearly showed the decrease in size for a given capacity. This was especially noticeable in the marine types, where space is always at a premium. One interesting slide showed two of the Vee-bloc connected for direct drive on either side of the motor. Mention was made of the increase in speeds of the modern compressor up to 1,500 r.p.m. and of horse-power to 300.

Included were many slides of the various types of condensers ; atmospheric, that is losing favour ; shell and tube, evaporative and the blower type. The latter type are for use where water is in short supply.

Concluding with slides of some government cold stores erected during the war, the high loading banks were pointed out. Were they made high to facilitate loading or to serve a double purpose allowing a current of air to pass under to prevent frost-heave?, some asked.

A feature of these talks is the number of slides and charts that enable members to easily follow the subject. This was clearly proven on this occasion.

December meeting included the popular brains trust.

HALL'S CHIEF DESIGNER RETIRES

Mr. Donald W. L. Gough, chief designer of J. & E. Hall Limited, Dartford, since 1945, has retired.

Born in Wisbech in 1895, Mr. Gough came to Hall's in July, 1919, having served previously with Austin's of Birmingham where he worked on early type aeroplanes.

Mr. Gough worked first of all with Hall's as a draughtsman, his most outstanding job in those days being the well-known installation at The Grimsby Ice Company in 1933, being at that time perhaps the largest ice plant in the world.

Mr. Gough was made chief designer in December 1945, from which date he was responsible for designing all monoblocs and later type compressors, including veeblocs.

Mr. Gough is a keen tennis player and his hobbies include model engineering, gardening and photography, which should more than occupy him in his retirement.

INTEGRATION OF HAWKER FACTORIES

Petters to combine Staines and Hamble Works

From January 1, 1961, the company now known as Hawker Siddeley (Hamble) Ltd. is trading as Petters Ltd. and will function as the Hamble division of the company at Staines.

Petters Ltd. of Staines will continue to manufacture and sell diesel engines of 1½ to 108 b.h.p. and the Hamble works to manufacture and sell diesel generators, marine auxiliary sets, transport refrigeration equipment, bus shelters and sheet metal products, and will also provide Petter and Armstrong Siddeley spares and service, including the rebuilding of engines for the well-known Petter service engine exchange scheme.

The production of catamarans has been transferred to the boat building section of SARO (Anglesey) Ltd., Beaumaris, Anglesey, N. Wales.

Mr. J. C. Dacombe has been appointed to the board of Petters Ltd. as service manager, and Mr. T. D. Turner has also joined the board with the duties of general manager, Hamble works.

PRESTCOLD JOINS THE PRINTERS

Cooling equipment for a new type of British-built machine for the printing industry is to be supplied by Prestcold, it is announced. Speedy and completely automatic in operation, the machines will be used for process engraving work and marketed under the trade name of "Lithotex." The makers—Pictorial Machinery Ltd., of Crawley, Sussex—claim they bring automation to a section of the world of printing which has hitherto relied on lengthy hand methods carried out by craftsmen.

The machines have been modified from American designs and will be subject to U.S. patents. The majority of them will be exported overseas—many of them to tropical countries. Temperature control is an essential feature of their operating process.

APPLICATION OF PNEUMATIC CONTROLS TO AIR CONDITIONING*

By G. F. BROWN, M.I.H.V.E.

First, the basis of the operation of pneumatic controls was discussed and illustrated. Applications of this basic principle to air-conditioning problems was then described, again with illustrations.

The paper then discussed the application of pneumatic controls to some high-velocity systems.

1. BASIC PRINCIPLES OF PNEUMATIC CONTROLS

PNEUMATIC controls utilize compressed air as the source of energy by which they position dampers, valves, etc. Air is usually supplied at 15 lb/sq. in. and the controller varies the output pressure according to the condition of the variable it is controlling, which output pressure is balanced in the actuator against the resistance of a spring.

2. HIGH-VELOCITY INDUCTION SYSTEMS

Such systems comprise a central air-conditioning plant or plants from which air is distributed at high velocity round the building or a zone of the building into room induction units, where it induces room air to flow through the unit over a heater/cooler coil and to discharge into the room.

In winter, air is usually supplied to the units at a constant temperature somewhat below the required room temperature while at the same time hot water is supplied to the units. In summer the air is supplied at temperatures higher than the desired room temperatures while chilled water at constant temperature is circulated to the units.

By the above means individual rooms with internal sensible heat gains can be cooled in winter and in summer any rooms requiring it can be heated. For economical running it is usual to treat buildings with widely different heat gains or losses as different zones each having its own primary plant and secondary water system. In winter the hot water supplied to the unit is varied in temperature according to the load measured by an outdoor ambient thermostat and a solar gain thermostat, and in summer the primary air is supplied at temperatures which vary according to the load.

Fig. 1. shows a simple form of control for a single zone plant. T1 is a master thermostat measuring outdoor ambient air temperatures and TS is a master thermostat measuring solar effect. The signals are fed through a selector relay which selects the higher signal and applies this through manual changeover cock C2 either to T3 in summer or to T4 in winter.

T2 is a dew-point thermostat controlling the preheater coil by means of valve V2, and T3 is a submaster thermostat which controls the reheat battery by means of valve V3 when it has been reset upwards in summer. In winter the setting of T3 would be such that valve V3 is maintained open to the by-pass.

T4 is a submaster thermostat which in winter controls the temperature of hot water supplied to the unit by operating valve V4 which mixes cool return water with hot water supplied from the boiler or calorifier. C1 and C2 are ganged, manually operated changeover cocks and in changing from winter to summer the compensating signal from T1 and TS is applied to T3 controlling air temperature, instead of T4. Pressure is applied to changeover relay COR which moves the valve V4 into the by-pass position and applies air pressure to T5, which when the temperature return water has dropped to a safe level (about 80° F.) reverses valves V5 and V6 so that chilled water is circulated to the units.

At the same time a changeover valve V7 is operated to change the air supply to the unit controls from a pressure of 15 lb/sq. in. to a pressure of 20 lb/sq. in. to effect the changeover in their action as explained later. A pressure switch P operates to make a circuit to the condenser pump, chilled water pump and refrigeration compressor through suitable sequencing and time delay relays.

There are very many variations possible in design. For instance, the system might be such that in summer more sensible cooling is done to the units by the chilled water and the primary air would then be allowed to rise.

The changeover temperature between summer and winter shown as 60° F. in this diagram will in fact vary over a range of temperatures probably between 45° F. and 65° F. according to solar and other conditions.

When it is desired that the building be heated to some extent at night although the primary air plant and fan is shut down, the induction units will behave

* Excerpts from a Paper read before the Institution of Heating and Ventilating Engineers, November 24th, 1960.

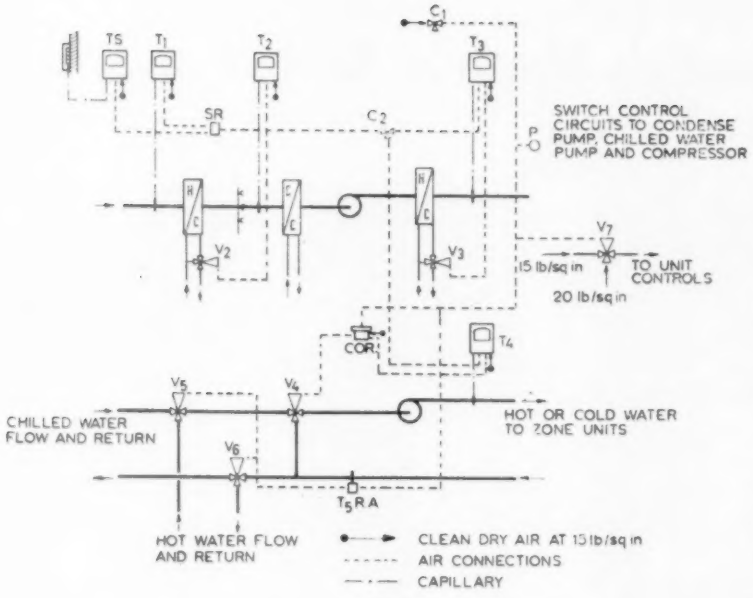


Fig. 1.

as natural convectors and higher temperatures, varied according to outdoor temperature, are supplied to the unit. For this a magnetic pilot valve linked to the primary air supply fan effects the changeover in control.

In the above control scheme no control of the cooling coil is shown and this will require, during periods in the summer season of low sensible heat load, some extra reheat and possibly low humidities in the space. Where this would be undesirable a thermostat is provided at the fan outlet to control the three-way valve on the return from the cooler.

Induction Unit Control

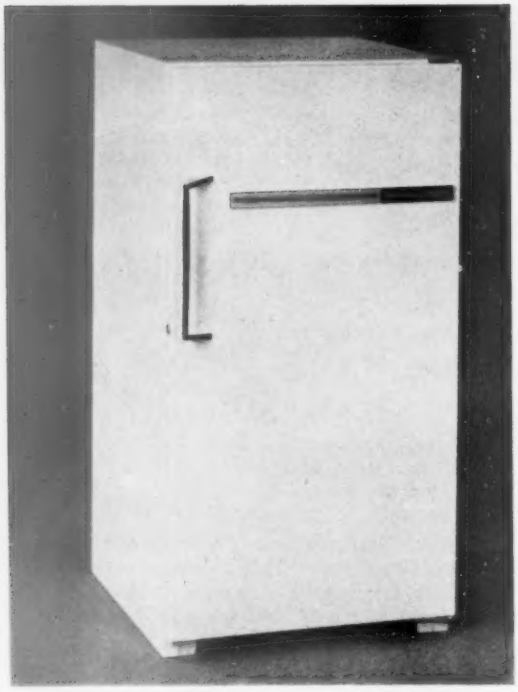
A summer/winter thermostat, that is to say, a thermostat incorporating both a direct and reverse acting system, placed inside the unit in the induced room air stream controls a two-way or three-way valve at the inlet to the coil. The action of the thermostat must, of course, be reversed according to whether hot water or chilled water is being supplied to the coils. The changeover is usually effected from the central plant room by changing the pressure of air supplied to the thermostat from 15 to 20 lb/sq. in.

It is sometimes convenient to effect the changeover locally at the zone, in which case the supply air pressure is changed from 15 to 20 lb/sq. in. by operation of a thermostat in the water supply.

Two-way valves enable the designer to make use of a diversity factor but it becomes necessary to control the differential pressure between flow and return from a zone by means of a differential pressure regulator and by-pass valve.

Prestcold's vast new £5,000,000 refrigerator factory at Swansea, one of the largest and most highly mechanized in Europe—had a surprise visitor recently in the form of Mr. A. D. M. Ross, Britain's Ambassador Designate to Portugal. He was on his way to a civic reception being held at the Guild Hall, Swansea, but, since he had heard so much about the mammoth Prestcold factory, decided to break his journey in order to make a quick tour of the plant. He is seen here signing the visitors' book, watched by Mr. C. F. Tracey, technical director at Prestcold (on the left) and standing behind him, Mr. Idris Evans, chief officer of the Welsh Office of the Central Office of Information and Mr. B. Smith, export administration officer for Prestcold.

New English Electric Models



English Electric's new 7.7 c.ft. refrigerator, Slimline 77, has nearly 12 sq. ft. of shelf area. A special feature is a full-width, deep-cold freezer in which frozen foods can be kept for three weeks, and even three months if certain precautions are taken with the food while defrosting. It is also fitted with an automatic interior light and automatic, push-button defrosting. There is a full-width salad crisper, spacious door racks for eggs, milk, tall and small bottles and a dairy-keeper. Finished in white with an interior colour scheme of glacier and arctic blue, Slimline 77 retails at £109 (including P.T. £16 17s.). English Electric's new 6 c.ft. refrigerator Slimline 60 has more than 10 sq. ft. of shelf area. Finished in white, with a neat, charcoal grey trim on the front of the cabinet Slimline 60 has an interior colour scheme of glacier and arctic blue. Price is £84 9s. (including P.T. £13 1s.).

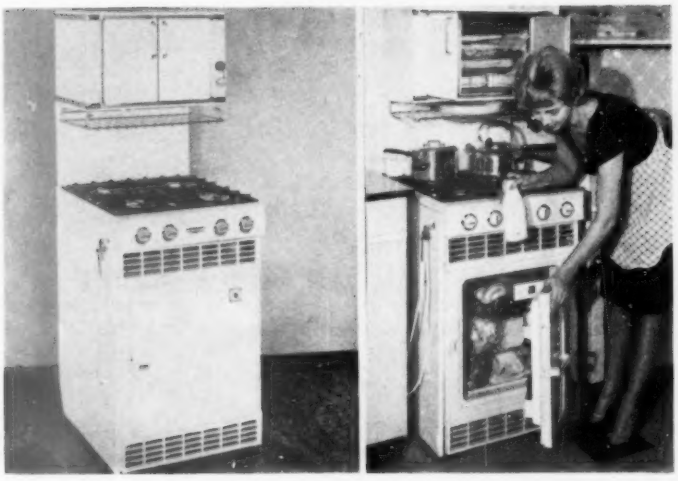
Pakamac Introduce New Model

Pakamac Special Products Limited have introduced a second refrigerator in their range. The new model, known as the "Pakamatic 250," is of 2.5 cubic foot capacity and retains many of the features of the 4 cubic foot "Pakamatic 350" introduced to the North in April, including a flat working top. The "Pakamatic 250" is being distributed nationally this month.

POLYZOTE MOULDINGS

A booklet entitled "Making Polyzote Mouldings," has been issued by Expanded Plastics Ltd. Polyzote (expanded polystyrene) is marketed in the form of boards, pipe sections, mouldings and expandable granules. The object of the booklet, which is illustrated, is to explain the methods by which the best use of Polyzote expandable granules may be obtained.

Combination Cooker-Refrigerator



The new CannonLux by Cannon (GA) Ltd. and Electrolux Limited is the first combined complete gas cooker and refrigerator unit—the perfect answer to the problem of accommodating a cooker and a refrigerator in the small kitchen. Designed to fit flush to the wall, the CannonLux comprises a built-in 1½ c.ft. Electrolux gas refrigerator, a giant size four-burner hot plate and a compact but capacious combined oven and grill chamber by Cannon.

(*Story on page* 72)

The new Lec BS.72 self-contained refrigerated bottle cooler. Claimed to be the first on the market to sell at less than £50, it has a capacity of 72 half-pint bottles or approximately 100 tonic size.

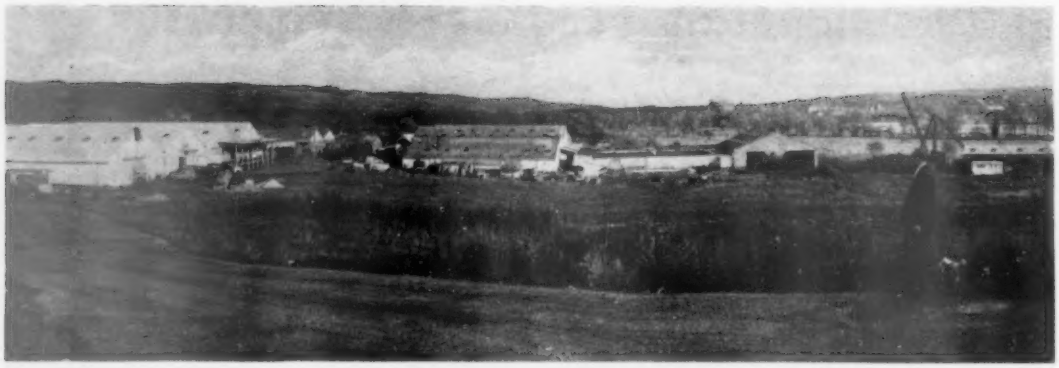
New Refrigeration Film.—Screened last month by The Electrical Development Association, film number six in the EDA educational film series replaces an older film called "The Refrigerator." It is in four parts, each self-contained, although it is advisable to show parts one and four together with either or both of parts two and three. It is intended for showing to the age group of 13 years and upwards. Part one—the how and why of refrigeration—deals with the fundamental principles of refrigeration generally and how it preserves food. The construction and working of a motor-driven compression refrigerator is dealt with in part two, while part three describes the principles and operation of an electrically heated absorption refrigerator. Part four shows how the refrigerator should be used, the need for defrosting regularly and how food should be placed in the cabinet.

OBITUARY

Mr. Harold Perry

The Aero Pipe & Glass Co. Ltd. has suffered a very great loss by the death of their founder and chairman, Mr. Harold Perry, M.IST.B.E., F.R.S.A., who passed away very suddenly at his home in Stanmore on November 28, 1960.

The late Mr. Perry was born at Bolton in Lancashire in 1882 and in 1928 became a founder and managing director of Gilt-Edge Safety Glass Ltd., Stone, Staffordshire. In 1945, he was a founder director and one-time chairman of Plyglass Ltd., of Harlow, Essex. In 1940 he founded the Aero Pipe & Glass Co. Ltd., of Yiewsley, Middlesex, and became managing director and later chairman of this company. He will be greatly missed by a wide circle of friends in the refrigeration industry.



The managing director, Mr. W. Davison, surveys his fast-growing enterprise. — *Special "M.R." pictures.*

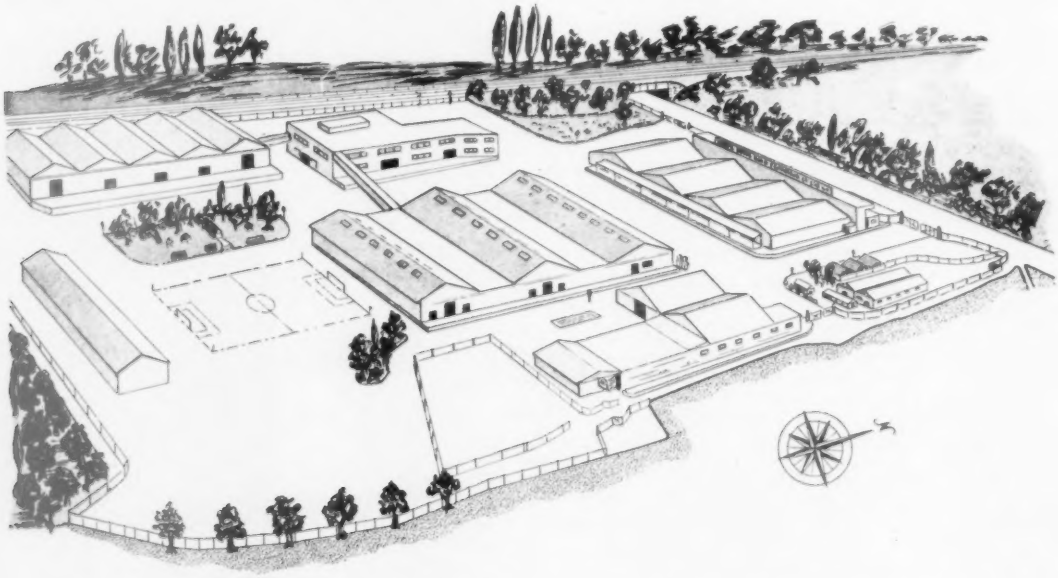
WEST KENT COLD STORE EXPANDS APACE

Six-year-old enterprise with half a million cubic feet of space

THE West Kent Cold Storage Company Limited, of Dunton Green, near Sevenoaks, Kent, is one of the fastest growing cold storage undertakings that has emerged in the post-war food-holding field. Formed only six years ago, the company now operates more than 500,000 c.ft. of refrigerated space, virtually all of which is capable of maintaining sub-zero temperatures.

The moving spirit behind this business is the chairman and managing director, Mr. W. Davison, who purchased the site of 20 acres as an undeveloped piece of land largely covered by a lake with a greatest depth of 40 ft. which had to be drained before any constructional work could begin.

In addition to providing sub-zero storage space on normal rental, the company has placed office and depot facilities at the



The final layout for the W.K.C.S. undertaking. The view above was taken from high ground beyond the fence at left of drawing.

disposal of one or two leading firms in the frozen food processing business and their south-eastern area distribution takes place from here. Also, fresh and chilled meat distribution is effected from Dunton Green by the Argentine meat exporters, C.A.P.

Although road transport units are chiefly concerned with the movement of food from the warehouses, a railway siding from the main London-Sevenoaks line provides an alternative transport service.

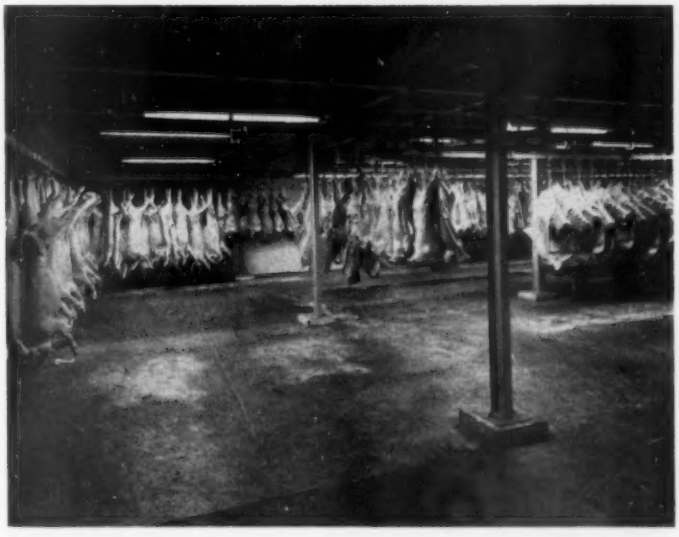
Quick-freezing facilities are available with two blast freezers operating at –15° F. ; each chamber is capable of freezing 20 tons every 24 hours. A liquid freezer is also available.

The refrigeration machinery, supplied by The Lightfoot Refrigeration Co. Ltd., was designed to produce a temperature of approximately –5° F. in the suitably insulated cold stores for the storage of previously frozen produce. Allowance was made for daily loading of 10 tons of goods. Change-over switches are provided to enable the fans to run independently from the machines.

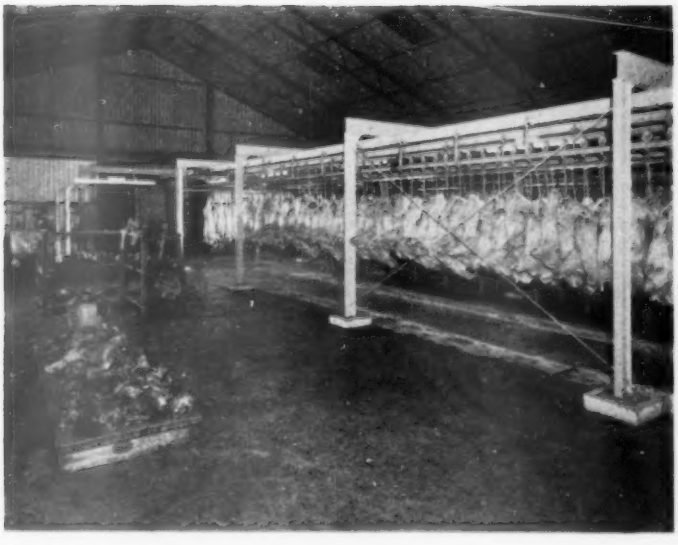
Each refrigeration set comprises a V.Q.8 Lightfoot compressor adapted to operate at 450 r.p.m. and driven by a 20-h.p. slip ring motor on three-phase electrical supply. Suitably rated water-cooled condensers and liquid receivers are supplied for each set. This equipment works in conjunction with a steel-finned, water defrost evaporator coil encased in galvanized sheet steel and has a perspex window through which the accumulation or dispersal of the frost on the coil can be observed. These evaporators are complete with 24-in. axial flow aerofoil fans.

A forced draught water-cooling tower, capable of supplying the requirements of the whole installation, is fitted, together with the necessary water circulation pumps.

The whole design of the stores and the machinery layout has been the special concern of the chairman and managing director, Mr. Davison, and several interesting features are incorporated. For instance, frost-heave is prevented by circulating oil, heated by the condensers, under the store floors. When the full installation has been completed, the offices will be heated by the condenser side of the plant as will be the staff swimming pool.



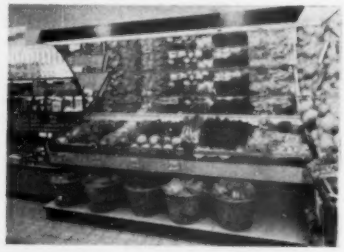
Two views of the spaciously laid-out meat depot operated by C.A.P., the Argentine meat exporters.

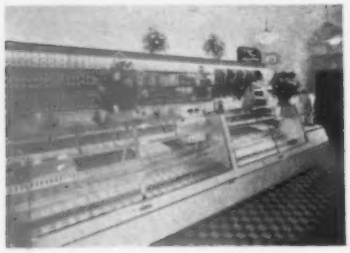


This building is at the top left hand corner on the drawing opposite.

SWEDISH CABINETS

Regular readers of "M.R.", Platindustri of Malmo, Sweden, have sent us illustrations of Swedish shop-equipment incorporating their refrigerated display cases. They manufacture about 3,000 units yearly and deliver these to a well-known U.S. refrigeration firm on the European market.





COMBINED REFRIGERATOR/COOKER

(*See page 69*)

Introduced to the British market at The Savoy Hotel, London, last month was the first complete combined gas cooker and refrigerator unit, produced by G. A. Cannon Ltd. and Electrolux Ltd.

Styled specifically for the family flat, the "CannonLux" provides a large-size four-burner hotplate and a combined oven and grill chamber—by Cannon, with a space-saving built-in "Sixteen" gas refrigerator—with 3¼ sq. ft. of shelf area and 1½ c.ft. capacity—by Electrolux, both merged into a compact kitchen unit to fit 21 in. × 25 in. of floor space—no more area than is occupied by an ordinary domestic cooker.

Designed to fit flush to a wall to save precious inches and so avoid the ugly dirt trap between wall and cooker which can annoy a housewife, the "CannonLux" comprises :

A Hotplate . . . mounted over the refrigerator 34 in. from the floor—the right height for convenient working. Its design provides a large-size cooking area of 20¾ in. wide by 20½ in. deep and its four hotplate burners accommodate four 10 in. pans, and light automatically. The two back burners are specially designed for simmering. The hotplate is completely sealed to prevent spillage seeping below the vitreous enamelled hotplate dish—from which it can easily be cleaned away.

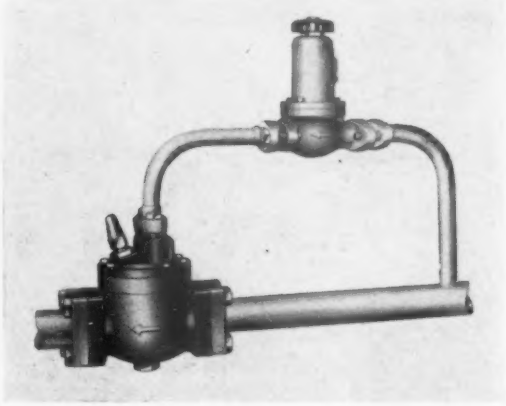
An Oven . . . conveniently positioned over the splashplate. Compact in design but capacious enough to cater for a family party, the oven has twin doors which do not project over the hotplate when they are open.

A Grill Chamber . . . quickly formed by fitting a removable grill into the top of the oven. It is easily and quickly slid into position on the top runners and removed again when the oven is required. A specially designed locking device prevents either the grill or oven burner being turned on when the other is in use.

With its exceptionally large grilling capacity it is possible to accommodate a mixed grill, steaks, fish fillets or chops for four persons, and the wide variety of other large and interesting dishes that can be

---

The Danfoss series of main valves for back-pressure regulators for large refrigeration systems has been further extended to include two low-capacity types. These valves have the designation MSA 20 with flange connexion from ¾" to 1¼" and MSA 25 with flange connexion from ¾" to 1¼".



cooked or finished off under the grill.

A Plate Shelf . . . fitted under the oven accommodates six to eight plates. It can be drawn forward to provide a useful working shelf when the oven or grill is in use.

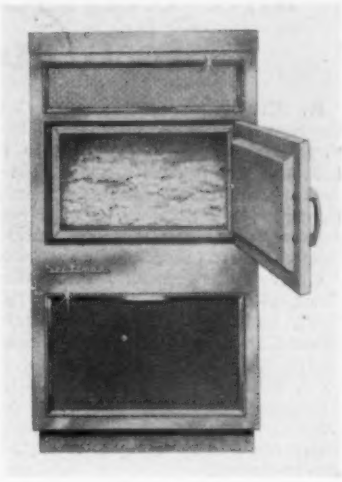
The cooker part of this joint production is, like the refrigerator section, designed as a space saver with plenty of space.

An Electrolux Gas Refrigerator . . . with 3¼ sq. ft. of shelf space. Features of the refrigerator include two removable door shelves for bottles, butter and eggs. A frozen-food packet can be stored in the ice compartment, which normally holds an ice tray with a flexible divider to provide 44 pieces of ice—with an easy release for individual ice cubes of just the right size for cocktails and cold drinks.

Alternative specifications of the cooker section of the " CannonLux " are also available.

Close-up view of huge gantry crane specially designed by Matson engineers to load and unload the aluminium containers described in December. This view, taken from the deck of the "Hawaiian Citizen," shows a container (24 by 8 by 8½ feet) being lowered into place.

New Scotsman Ice-Maker



The range of Scotsman automatic ice flake and cube machines, manufactured in the United States of America by the King-Seeley Corporation of Albert Lea, Minnesota, is being distributed in this country by M. L. Winsor & Co. Ltd., of Finland House, 56, Haymarket, London, S.W.1. The range includes cubers with capacities from 1 cwt. to 5 cwt. per day, and flakers from 1 cwt. to 2 tons per day, all at very reasonable prices and compact and efficient in operation.

PRESTCOLD SALES CONFERENCE

As already mentioned in these columns, distributors, marketing managers and scores of executives from all parts of the nation-wide Prestcold sales network attended a series of annual sales conferences recently at the new Prestcold factory, Swansea. An official of the company commented afterwards that the meetings were a huge success and that, in spite of the present Government credit squeeze, sales were expected to expand during the forthcoming year. Highlight of the conferences was a special pre-view of the new Prestcold range of domestic and commercial models for 1961. The programme provided for a tour of the factory—one of the largest and most highly mechanized of its type in Europe.

U.S. Air-Conditioning and Refrigeration Institute*

R. K. Serfass, manager of Westinghouse Electric Corporation's Air-Conditioning Division at Staunton, Virginia, was elected president of the Air-Conditioning and Refrigeration Institute, trade association of the industry, at its annual meeting in Florida last month. He succeeds Rudolf G. (Rudy) Berg, vice-president of Copeland Refrigeration Corporation, Sidney, Ohio, as chief executive officer of the Institute.

Other officers include three vice-presidents—Russell Gray, vice-president of Carrier Corporation, Syracuse, N.Y., and L. N. Hunter, director of engineering for Crane Company's Plumbing, Heating & Air-Conditioning Group, Johnstown, Pennsylvania, both re-elected, and F. J. Kreissl, president, Detroit Controls Division of American Radiator and Standard Sanitary Corporation, Detroit, Michigan—and a treasurer, W. H. Aubrey, president of Frick Company, Waynesboro, Pennsylvania, also re-elected.

The new ARI president has served as vice-president and chairman of the Institute's planning committee for the past year, and has been active in the affairs of the association over a long period of time. A native of Allentown, Pennsylvania, Mr. Serfass holds a B.S. degree in industrial engineering from Lehigh University, and was connected with York Corporation for 25 years before joining Westinghouse in his present post in 1958. He was a vice-president of York Corporation when he resigned to make the move to Westinghouse.

In addition to the officers, four new directors were named by ARI. They are : Cecil Boling, president and treasurer of Dunham-Bush, Inc., West Hartford, Connecticut ; and Joseph B. Elliott, president, York Division, Borg-Warner Corporation, York, Pennsylvania, both directors-at-large, and L. P. Benua, executive vice-president, the Ebco Manufacturing Company, Columbus, Ohio, representing the water cooler section, and J. G. Landrigan, general sales manager, United Wire & Supply Corporation, Providence, Rhode Island, representing the tubular products section. Mr. Benua succeeds Lud Emde, president of Temprite Products, Inc., a past-president of ARI, as representative of the water cooler section, and Mr. Landrigan succeeds E. W. Ervasti, general sales manager, Calumet & Hecla of Canada, Ltd., in representing the tubular products section.

Re-elected to the ARI board of directors were B. E. James, president, McQuay, Inc., Minneapolis, representing the heat transfer section ; E. R. Michel, manager of sales, air-conditioning and refrigeration division, Worthington Corporation, East Orange, New Jersey, reciprocating liquid-chilling packages section ; D. V. Petrone, president of Typhoon Air-Conditioning Division, Hupp Corporation, Brooklyn, unitary air-conditioner section, and Russell Gray, Carrier Corporation ; L. N. Hunter, and John W. Norris, president, Lennox Industries, Inc., Marshalltown, Iowa, directors-at-large.

All members of the board of directors were elected for three-year terms, with the exception of Mr. Elliot, who was named to serve the unexpired term (one year) of Henry Haase, former president of York Corporation, who resigned from his ARI office upon transferring out of the air-conditioning and refrigeration field.

Continuing members of the ARI board of directors whose terms of office expire one and two years hence, include :

Representing product-sections : Rudy Berg, Reciprocating compressor and condensing units section ; R. L. Gibbs, sales manager, Mueller Brass Company, Port Huron, Michigan, valves, driers, fittings and accessories section ; Thomas Hancock, executive vice-president, The Trane Company, La Crosse, Wisconsin, centrifugal liquid-chilling packages section ; Elmer Hoefle, vice-president and sales manager, Universal cabinet division, Universal Metal Products Corporation, St. Louis, Missouri, ice cream cabinet section ; Henry O. Kirkpatrick, president, American Manufacturing Company, Montgomery, Alabama, mobile refrigeration section ; G. A. Schnier, sales manager, American Potash & Chemical Company, Los Angeles, refrigerants, lubricating oils and chemicals section ; R. K. Serfass ; A. L. Topp, vice-president, sales, Controls Company of America, Schiller Park, Illinois, flow control valves section, and V. D. Wissmiller, market manager, commercial division, Minneapolis-Honeywell Regulator Company, Minneapolis temperature controls section.

Directors-at-large W. H. Aubrey ; Paul M. Augenstein, president, Airtemp Division, Chrysler Corporation, Dayton, Ohio ; F. J. Kreissl ; C. W. Moeller, manager, Air-conditioning department, General Electric Company, Louisville, Kentucky, and T. W. Rundell, vice-president, Tecumseh Products Company, Tecumseh, Michigan.

*We feel sure that this list of U.S. refrigeration personalities will be of interest to our readers.

Electricity Board Sales Drop

Sales of new domestic refrigerators by Area Electricity Boards in England and Wales in the month ended September 30, 1960 totalled 8,124, 40·6 per cent less than in the corresponding period of 1959. Total sales in the 12 months to September 30 were 141,241, a 14·2 per cent decrease.

* * *

A new liquid oxygen plant, the largest of its kind in Latin America, was put into production recently by the Union Carbide Corporation affiliate, S. A. White Martins, at Rio de Janeiro. The plant has a capacity of 25 m. c.ft. monthly. Storage facilities for 10 m. c.ft. of liquid oxygen are provided.

* * *

Following some 15 years' of reconstruction work—carried out a section at a time—John Lewis's Oxford Street, London, store has officially been re-opened. Prestcold have provided some 34 separate items of refrigerating equipment consisting of meat and fish stores, wine stores, service shelves, ice-cube makers, ice-cream conservators, water dispensers, bottle coolers, service cabinets—even the atmosphere is air-conditioned by Prestcold.

* * *

A symposium on the use of secondary surfaces for heat transfer with clean gases was held at the Institution of Mechanical Engineers in London on November 9 and 10 under the aegis of the British Nuclear Energy Conference. The papers presented and discussed were classified under the headings of cross-flow and fuel elements.

The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

FEBRUARY MEETING

At the meeting of the Institute to be held on Thursday, February 2, 1961, at 5.30 p.m., at the Institute of Marine Engineers, The Memorial Building, 76, Mark Lane, London, E.C.3., Mr. Carl Munters and Mr. Lennart Lindqvist will present a paper entitled " A new conception in cooling tower design."

The following is a summary of the paper:—

A closer analysis of the heat and moisture transfer processes shows that an important reduction of the size of the transferring elements can be achieved by forming the exchanger elements with narrow channels, so narrow in fact that a purely laminar flow is obtained.

The width of the channels has a predominant influence upon the volume of the exchanger, the volume decreases with the square of the width of the channel. The depth in flow direction of the exchanger can be kept extremely small, even at high efficiency values.

The new type of cooling tower described has its fill made according to this principle. A number of problems have to be solved in connexion with the practical design of the cooling tower fill. One of them is to eliminate the influence of the capillary action, so that the narrow channels can be drained and kept open for the air flowing through. To achieve the best performance of the fill it is necessary that the surfaces are easily wettable. This requirement can be fulfilled by selecting a suitable combination of sheet material and impregnant.

An extensive field test programme has been carried through.

A special water distributor which gives a very uniform water distribution is used in connexion with this cooling tower fill. The new, compact and very light cooling tower fill has made it possible to reduce the weight and size of the cooling tower in comparison with the prevailing designs.

The use of a heat transfer element of the type described is not limited to cooling towers only. It can also be used for instance in scrubbers and humidifiers.

MEMBERSHIP

At the meeting of members held on December 1, 1960, the following were elected to membership of the Institute:—

MEMBER

Cooper, Charles Edwin Bertram, John Thompson (Wolverhampton) Ltd., Ettingshall, Wolverhampton.

ASSOCIATE MEMBERS

†Chen, Kung Wang, Brunei Shell Petroleum Co. Ltd., Seria State of Brunei, Borneo.
Finegan, Patrick J., Hinton House, 11, Woodside Drive, Castle Park, Rathfarnham Dublin.
Hodsdon, Ian George, 11, Monks Orchard, Wilmington, Dartford, Kent.
Kenworthy-Neale, Gordon, 54, Aintree Lane, Liverpool, 10.
†Whalley, Arthur, Johnson & Fletcher Ltd., P.O. Box 588, Salisbury, S. Rhodesia.

† Transfer from Graduate

COMPANION

Marks, Cecil Montefiore, 242, Tottenham Court Road, London, W.1.

ASSOCIATES

Anklesaria, Eruch D., Tawahi Cold Storage, Mihraq Road, Tawahi, Aden.
Brown, Ernest Farrow, 7, Lanark House, U.K. Diplomatic Compound, Chanakya Puri, New Delhi, 21, India.
Davison, William, The Poplars, Church Road, Sundridge, Nr. Sevenoaks, Kent.
Fletcher, Tom Cattell, 34, Glendale Gardens, Wembley, Middx.
Haslam, Lancelot Albert Kenneth, 4, Tanfield Avenue, Neasden, London, N.W.2.
Scutt, Percival Robert, Basrah Petroleum Co. Ltd., P.O. Box 21, Basrah, Iraq.
Wintle, Royston Vivian, 141, Bishopston Road, Bishopston, Gower, Swansea.

GRADUATES

†Jaquiss, Roger, 16, Derwent Drive, Brooklands, Sale, Cheshire.
Julius, Willem Paul, The Croft, Hillcroft Avenue, Purley, Surrey.
O'Neill, Peter Aloysius, Mossend House, Lochwinnoch, Renfrewshire.
Wu, Augustine Bick Lun, c/o Mrs. Freeman, 118, Dowanhill Street, Glasgow, W.2.

† Transfer from Student.

STUDENT

Taylor, Barrie, 214, Palatine Road, Blackpool.

INTERNATIONAL CONFERENCE ON HEATING, VENTILATING AND AIR-CONDITIONING

The Institution of Heating and Ventilating Engineers is organizing an International Conference in London from September 27 to October 4, 1961. The Conference will be held at Olympia, London, in a specially designed Conference Suite, fully equipped and acoustically treated. It will coincide with a comprehensive exhibition, covering the Heating, Ventilating and Air-Conditioning fields, opening at Olympia on September 26 and closing on October 6, 1961.

The Conference will cover three main themes:—

1. **Administrative Advances likely in the next ten years.**

   This will include Papers on the future aspect of such topics as training, education, labour

relations, organization of research, site operations and contract planning.

2. **Technical Advances likely in the next ten years.**

   This will include Papers on the likely trend and advances in the Heating, Ventilating and Air-Conditioning fields with particular reference to Hospitals and Office Buildings. The present direction of research and the likely outcome in practice will be discussed.

3. **Integrated Design of Architectural and Engineering Services for Economy of Building Construction.**

   This will include Papers describing methods of relating the technical and economic variables of a building project and co-ordinating them so as to produce the optimum solution in cost and performance. They will also deal with the relationship between owner, architect, engineer and other interests involved in the production of modern buildings.

Papers have been invited to form the basis of discussion but any other Papers relevant to the Conference will be warmly welcomed and will be considered for inclusion in the Conference programme.

A programme of visits of technical interest is being arranged, as well as social events for delegates and their ladies. A particularly warm welcome is extended to ladies accompanying delegates, for whom a special programme will be arranged, including visits to places of interest in and around London.

Copies of a leaflet giving details of the Conference and a provisional enrolment form may be obtained from the Secretary, The Institution of Heating and Ventilating Engineers, 49 Cadogan Square, London, S.W.1.

THE REFRIGERATION RESEARCH FOUNDATION

Two rather interesting items appeared in the November, 1960 issue of the Information Bulletin of the Refrigeration Research Foundation, Colorado Springs, U.S.A.

Liquid Nitrogen Cooling of Air in Trucks

The U.S.D.A. Agricultural Marketing Service has just released a report on a test of a single frozen food distributing truck using liquid nitrogen to maintain the truck air at a low temperature.

A simple nitrogen spray system was installed in the truck. A single pipe ran along the ceiling from the front to the rear, from a main storage tank.

Liquid nitrogen was sprayed out of this pipe directly on the load. As it flashed into a gas it expanded about 700 times, forcing the warm air out of the truck and replacing it with cold, dry nitrogen.

Once the temperature was established it was easily maintained although the report does not indicate whether this was hand or thermostatically controlled.

The report does not indicate the air temperature of the truck nor the number of stops made, but during the five-day test period the average temperature of the frozen foods when leaving the warehouse was 12° F. and the average lading temperature at the last delivery was 9°F.

This they report is noticeably better than in trucks cooled by conventional methods, but it is not indicated whether the conventional methods include trucks with air ducts dispersing the air to several areas of the interior.

The report indicates the system is inexpensive and easy to install. Cooling is more evenly distributed. Control is excellent, pull-down time is shorter and humidity is lower with the packages drier and easier to handle. The disadvantage is the cost of the nitrogen. They report that dry ice costs about 4 cents a pound, liquid carbon dioxide 4 to 5 cents, and liquid nitrogen 2 to 8 cents. It is sold on a sliding scale and to get the lower rate large quantities must be used.

ODOUR TRANSFER IN THE STORAGE OF FROZEN FOODS

The transfer of odours from one frozen food to another during storage is eliminated by proper packaging, according to a research report by Dr. E. A. Fieger and A. F. Novak of the Department of Agricultural Chemistry and Biochemistry, Louisiana State University, Baton Rouge, Louisiana.

Deep-fat-fried chicken and butter were packaged in several ways, frozen, and stored with and without the presence of frozen ocean perch in its standard commercial package. Storage was in 50 lb. lard cans, with lids sealed on with tape.

Samples were removed for odour and flavour tests approximately every six months during a three-year period. A fish odour was present in the cans when opened for sampling purposes.

The deep-fat-fried chicken, heat sealed in Mylar bags, showed no fish odour in 35 months storage. Butter, in quarter prints, 4 to the carton, and overwrapped with heat sealed "Cellophane" bags, was without odour, while butter without the "Cellophane" wrap was distinctly fishy within seven months.

From these results it is evident that proper packaging can prevent the transfer of odour from one frozen food to another. It should also be pointed out that butter manufactured from some grades of cream develops a fishy odour during storage without fish being present. This fishy odour comes from break-down products of the butter due to ageing during storage.

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COMMERCIAL AND INDUSTRIAL SECTION

A versatile series of air-cooled split-packaged air conditioners are now being manufactured by **Carlyle Air Conditioning and Refrigeration Ltd.**, London. These are introduced to fit the need where space is at a premium and cooling water is not easily or cheaply available. By separating the condensing and fan coil air handling units, it is possible to install them independently in the most convenient positions. The fan coil will fit either vertically or horizontally, at floor or ceiling level, with the air discharge or registers in any direction. The condensing unit can be placed in any unused space and connected to the fan unit by small lines of refrigerant tubing. The latter is, incidentally, available for use either in direct expansion systems or with chilled water. Available in four sizes from 30,100 B.t.u. per hour to 106,000 B.t.u. per hour the condenser is compact, the smallest measures 1 ft. 11 in. by 2 ft. 1 in. by 2 ft. 0 in., the largest is 6 ft. 0 in. by 3 ft. 0 in. by 3 ft. 9 in. These may be combined with three distinct fan coil units, with cooling capacities of 54,000, 79,000 and 122,000 B.t.u. respectively. The largest model can handle air up to 5,000 c.ft. per minute, and stands 6 ft. 3 in. high, 5 ft. 3 in. wide and 2 ft. 1 in. deep.

* * *

It is announced by Sir Miles Thomas, chairman of the board of directors of **Monsanto Chemicals Limited**, that John C. Garrels Jr. of Springfield, Mass., U.S.A., has been elected to be a member of the board and has been appointed to the position of deputy managing director of the company. Mr. Garrels has been an assistant general manager of Monsanto Chemical Company's plastics division since 1956. He will assume his new responsibilities early in 1961, as soon as he can establish residence in Britain. Born at Detroit, Mich., in 1914, Garrels was graduated from the University of Michigan in 1935 with a BS degree in chemical engineering. He came to Monsanto as a chemical engineer in 1942. He joined the plastics division in 1946 as manager of a plant Monsanto then operated at Lockport, N.Y. In 1948 he was promoted to manager of the Springfield plant. He became divisional production manager in 1950 and director of manufacturing in 1954. In 1955 he was appointed assistant general manager in charge of manufacturing. When he assumed his present position he was placed in charge of marketing, research, manufacturing, engineering and personnel relations for the division.

* * *

Dewhurst & Partner Ltd., Hounslow, announce the development of a range of emergency push-button units which comply with the Ministry of Labour's recent order concerning the installation of fire alarms in factories. Enclosed in a robust cast-iron box with plain glass insert the normally open (make) contacts are of high quality brass, whilst the normally closed (break) contacts are silver tipped. A hammer is provided with each unit and is attached to the case by a short length of chain. The unit is finished in pillar-box red with raised white lettering. Four models are offered.

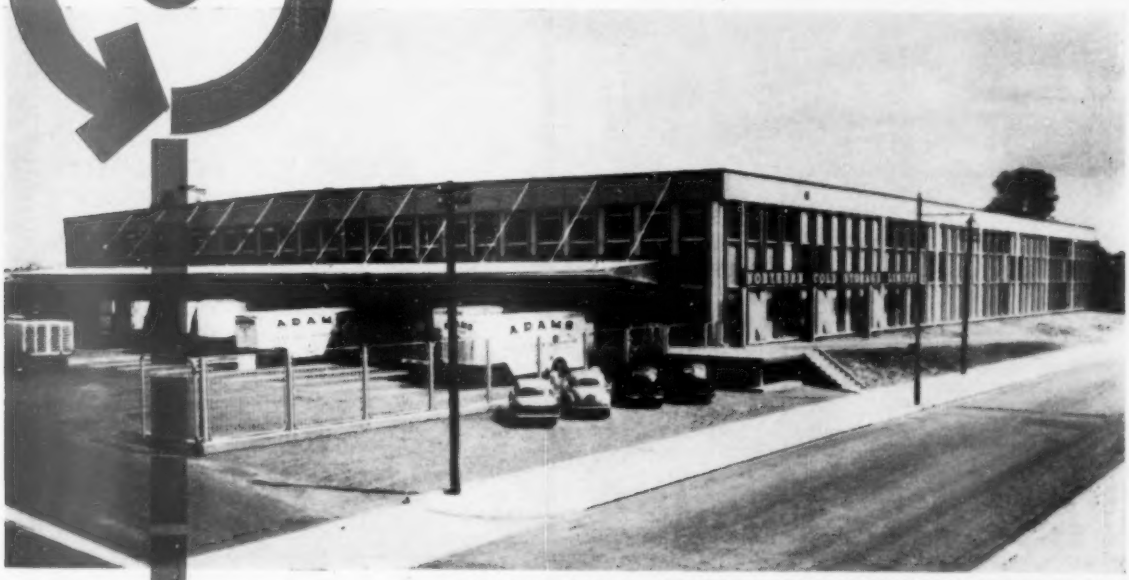
* * *

FOIL BANNERS

The appearance of large expanses of printed aluminium foil has been used to unusual effect by **Simplex Electric Co. Ltd.** in a new presentation scheme for their Creda range of refrigerators and cookers. The foil, in the form of colour-printed "banners," gives each appliance a durable yet easily-removed label that is an immediate identification in the showroom. The fact that nearly all domestic refrigerators are basically the same colour, white or ivory, makes the part played by special display material more than usually important. Few potential buyers will recognise a particular make of refrigerator by its shape. But, at the same time, few will consider very "tasteful" a machine that has the maker's name prominently and permanently emblazoned on its door. Simplex found the answer in large, attractively-designed paper labels which could be attached to a refrigerator as it left the production line and removed when it was installed in the home. The latest versions of these labels have been printed on foil. The advantage is two-fold. The foil, backed by a special non-curling paper, is a good deal stronger

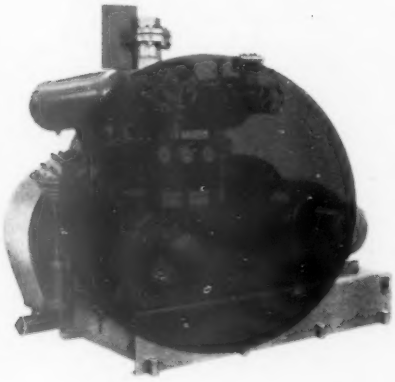
The Marchioness of Ailsa, who opened the South of Scotland Electricity Board exhibition, with (on her left) Mr. William Hutton, deputy chairman of the Board, and Mr. John S. Carruthers, Sterne's sales manager for Scotland. At the rear is a Temperature cellar cooler.

This is No 2 in a series of advertisements by STAL Refrigeration AB — a company of the de Laval Ljungstrom Group



Northern Cold Storage Ltd., Grimsby. Built by Helsingborgs Fryshus AB, Sweden.

562 tons of refrigeration at —20°F



Up to 6 750 000 BTU/h are produced in the ultra-modern cold store of the Northern Cold Storage Ltd., Grimsby, today Europe's largest and most modern plant for temperatures down to —20°F. Storage volume is 3 180 000 cu.ft., all on one floor, and capacity is 28 000 metric tons of frozen food.

5 compressors of STAL's famous HEAVY DUTY series, each with a capacity of 1 350 000 BTU/h, are servicing this huge cold store, where handling is fully mechanized. In this case the refrigerating circuit was designed as a booster system. STAL compressors can, however, also be supplied as 2-stage machines for low temperature plants.

The STAL compressors are made to cope with all applications in the industrial and marine refrigeration fields as well as in air-conditioning. Their compact and space-saving design and their moderate speed combine the advantages of modern principles of refrigeration technique with long life and dependable service. All commonly used refrigerants, R12, R22, ammonia, etc., can be employed, and the capacity range is 4000 to 3 600 000 BTU/h.

There are always many ways to the goal. "The STAL way is the better way" — and the underlying principles are applied by the STAL engineer to both compressor and plant design. The steady search for this "Better Way" has led to great achievements in the field of refrigeration and to the ever-growing reputation of STAL in the markets of the world.

STAL Refrigeration

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VACUUM FORMING

Areas up to 60″ x 40″

Depth of draw up to 17″

Ekco Plastics have unrivalled experience in the production of vacuum-formed liners and other plastics refrigerator components.

Up-to-the-minute equipment and highly skilled technicians enable Ekco to meet almost any requirement for large-size vacuum forming with maximum efficiency and economy. And the Ekco reputation for quality means you can rely on a component of *consistently* high standard—whatever the quantity.

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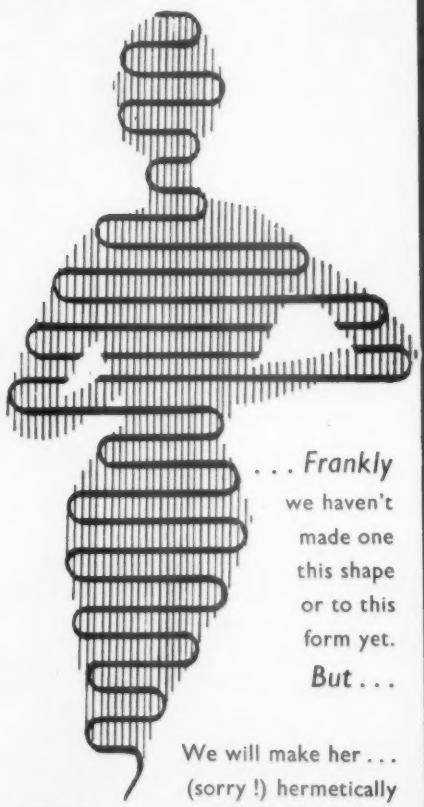
REFRIGERATION SYSTEMS

in any shape or form—

MADE TO MEASURE



. . . Frankly we haven't made one this shape or to this form yet. *But . . .*

We will make her . . . (sorry !) hermetically sealed systems to your requirements

SHERWOOD

SHERWOOD ENGINEERING CO. LTD.

Sherwood Works
62 GEORGE STREET
WAKEFIELD, YORKSHIRE
Telephone : 6144 (3 lines)

than the original unsupported paper which tore easily when the refrigerators were handled in the warehouse or in the showroom itself. And the

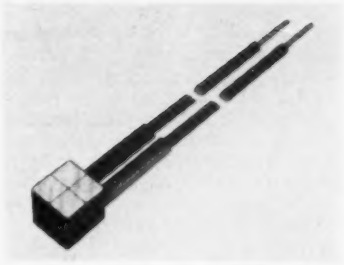
presentation, Simplex say, is considerably more striking than could economically be produced on paper.

* * *

At a short ceremony attended by directors of the **Teddington Group of Companies,** Sunbury, 18 boys received indenture certificates of completed apprenticeship from Mr. E. Ower, a director of the parent company, The British Thermostat Co. Ltd. Mr. Ower, in making the presentation, said : "You are to be congratulated on obtaining your certificate which has been earned by hard work, and you are indeed fortunate to have had the help and guidance of Mr. H. Hodkin, your apprentice supervisor." The apprenticeship committee found selection of "the best apprentice of the year" most difficult and this year the prize of 25 guineas awarded annually by the directors was divided between S. Whittle and J. Benham.

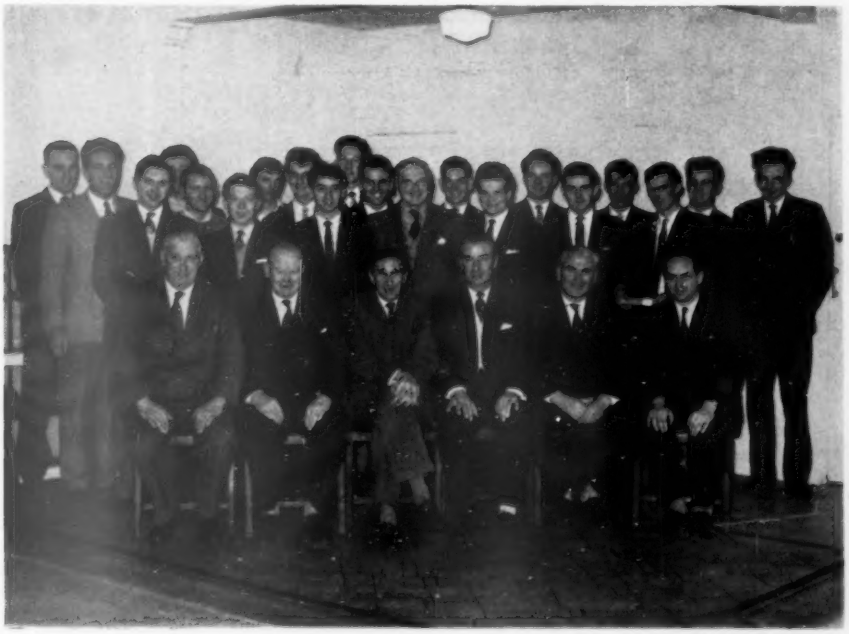
* * *

The first of a range of thermoelectric cooling units to be marketed by a British manufacturer has been introduced by **Salford Electrical Instruments Ltd.** (a subsidiary of the General Electric Co. Ltd.), following an extensive research programme at the G.E.C.'s Wembley laboratories. Based on the Peltier effect, the cooling capacities of the units vary from less than 1 W. for a single junction type to more than 10 W. for a large multiple junction. They thus cover a range which cannot be conveniently dealt with by conventional means of refrigeration. The first of the group to be readily available is the BT.4, a four-junction unit with a cooling capacity rated nominally at 1 W., although the rating can be increased with a resultant reduction in temperature depression. Alternatively, a greater temperature depression can be achieved by reducing the rating. The BT.4 is made in the shape of a small cube, and thermal junctions are formed by a combination of "p" and "n" types of a



Thermoelectric cooling unit by Salford Electrical Instruments Ltd.

bismuth telluride semi-conductor material. In use, the block is clamped between the object to be cooled and a heat sink. Typical of its many applications is the cooling of electronic components which must operate in high ambient temperatures, when it serves to increase the power ratings of transistors, reduce the dark current in phototransistors, or—in the case of quartz crystals—to allow operation at the inversion point or other selected part of the frequency deviation / temperature characteristic. Other applications are with laboratory equipment such as microtome knives or microscopic



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Teddington Apprenticeship gathering. L. to r. seated: Mr. G. T. Mills (managing director, P. W. Baker Ltd.), Mr. U. G. A. Tonge (managing director, T.R.C. Ltd.), Mr. E. Ower (director, B.T.C. Ltd.), Mr. E. Richards (group personnel officer), Mr. S. H. Parker (managing director T.I.E. Ltd.), Mr. R. O. Seward (managing director, T.A. Ltd.); centre standing: Mr. H. Hodkin (apprentice supervisor).

★

slides where local cooling is essential; with instruments such as dew-point hygrometer heads where thermo-electric cooling involves changes in techniques and resultant simplification in the equipment ; and with the cooling of small volumes by incorporating one or more units into the walls of a chamber. Here, the temperature may be held constant by a proportional controller which allows smooth regulation of the cooling rate via the d.c. current applied.

Expanded polystyrene is a difficult material to stick and to solve this problem **Polybond Ltd.** have perfected a means of sticking this increasingly widely used material quite quickly and simply to any other building material. The method, briefly, is to prime the polystyrene section with Polybond, diluted with four parts of water. The surface to which bonding is to take place is similarly primed. An adhesive mix is prepared consisting of Polybond and ordinary cement, equal parts by volume. Water is added, if necessary, to form a firm workable mass. The

expanded polystyrene is then " spotted " with the adhesive mix and the panel fixed into place. " Grab " is immediate but with up to 10 minutes for moving about for final positioning without loss of adhesion. When the adhesive is set the bond is complete, and the expanded polystyrene cannot be moved.

* * *

Cleaner and easier to apply than conventional sealing compounds " Hilflon " unsintered PTFE tape is the latest development of the PTFE Division of William Rose Ltd. Manufactured from the inert non-toxic thermoplastic polytetrafluoroethylene, it possesses good thermal stability with resistance to most known chemicals, acids, alkalis, oils, corrosive liquors and gases. Available in a compact roll, it is

Morphy-Richards Appointments

Mr. A. W. Sinclair has been appointed a member of the board of Morphy-Richards (Astral) Limited as sales director.

Mr. Roger Morgan has been appointed to the board of Morphy-Richards (Cray) Limited as home market sales director.

Ice Cream Merchandizing

The problems of merchandising ice cream in display cabinets have involved considerable and intensive research. Now, a 9-c.ft. cabinet has been produced to offer a " new look " in ice cream presentation. Known as the " Universal 9," the refrigerator is being made available by Lyons Maid to their dealers and prospective dealers. It is claimed to overcome difficulties experienced in ensuring even firmness of contents.

The cabinet has four divisions, designed for the display of frozen foods as well as ice cream. The exterior is finished in white baked-on enamel with stainless steel trims, slide-away night cover and full-length 13-in.-wide serving opening. The interior is floodlit. Dimensions are 4 ft. $1\frac{3}{4}$ in. long, 2 ft. $7\frac{1}{4}$ in. deep, and 3 ft. 3 in. high. The cabinet is sold at £173 10s. which includes £20 worth of ice cream free. Hire purchase terms available are £25 down with the remainder spread over 12 months to two years.


OUR
RESOLUTION
FOR 1961...
Immediate Despatch
on models
JRE · WME · UCE
LTE and EDE
SEARLE BUSH UNIT COOLERS
CARRIAGE PAID IN ENGLAND
SCOTLAND AND WALES
YOUR
RESOLUTION
FOR 1961...

economically dispensed and transported, thus removing the need for storing bulky containers and drums in which the more conventional

sealing compounds, such as white lead, hemp and graphite, must be kept. Its operational temperature range is from –450° F. to +550° F. It is chemically inert to such agressive gases and solvents as the following: hot fuming nitric, sulphuric acid, hydrochloric acid, ammonia, chlorine, "freons," benzene, trichlorethylene, and carbon tetrachloride.

THERMOTANK COOLING TOWER

Conventional cooling towers depend for their performance on relatively widely spaced elements. The main drawback of these is that they are not easy to wet. A new cooling tower now being manufactured by the International Products Division of **Thermotank** embodies what is said to be a "revolutionary" principle in element canstruction and arrangement. This is a lightweight plastic-impregnated cellulose material, combining outstanding qualities of water absorption with high resistance to deterioration under the toughest operating conditions. Water is distributed from a self-propelled rotating header at low pressure, forming a thin continuous film over the entire fill surface, which is such an efficient, compact heat transfer medium that it takes up only one-fifth of the space of conventional wooden slats.

The new material which was developed by the well-known Swedish inventor, Carl Munters, is formed from plastic-impregnated wood cellulose. Thin sheets of the material when corrugated and joined together into manageable pads form the basis for the new fill. The corrugated construction gives almost tubular passages, resulting in a very compact fill having the greatest surface area for heat transfer and also the greatest unrestricted free area for air passage possible per unit volume.

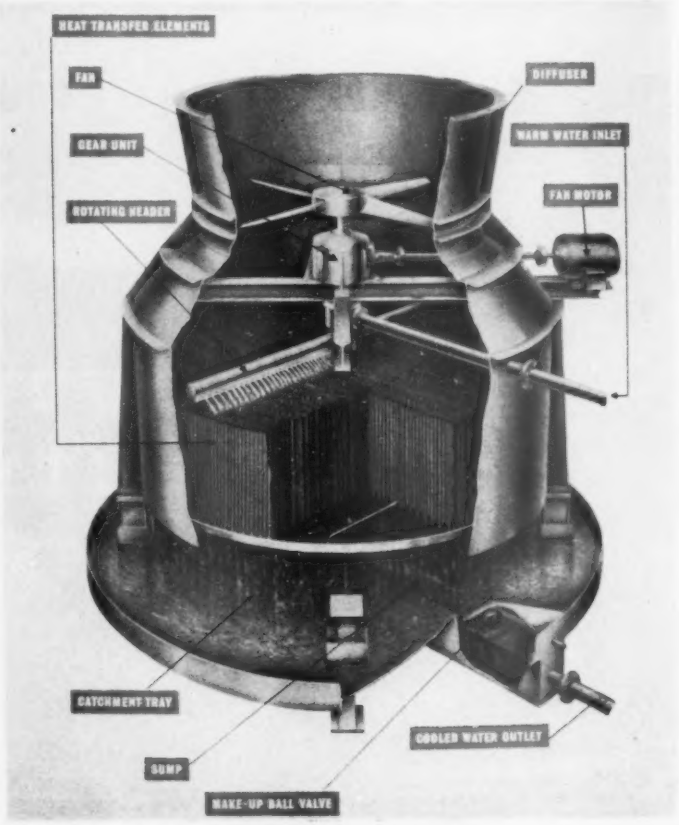
To overcome capillary action in the narrow passages, which causes water to build up at the lower edges blocking the flow of air, the fill is cut in a tooth-like formation. In effects this cuts each tubular passage at an angle which is the best and easiest way to drain an ordinary tube. Furthermore, the water leaving the passages high up on the flank of the teeth runs, not over the passages, but along the edges of the sheets to the tips where it drains off, thus providing free passage for the air.

The fill is constructed in rigid units and requires no spacers or other components. It is also self-supporting over its depth and does not impose any great load on its mounting. Hence tower construction and fill installation are simplified.

The raw material from which the fill is fabricated has a very high absorbent quality, which ensures good wettability. This high absorbency is further increased by treating the material with special agents particularly to impart high wet strength and good deterioration resistance.

The new design consists of a structure of rolled steel shapes, a galvanized steel casing, an internal water distribution system, a fan and drive assembly, and the heat transfer fill.

The structure is fabricated from rolled steel channels and angles and is designed to withstand a normal wind force of 30 lb. per sq. ft.



Competitors are infuriating people. Their machines are always bigger and more modern than yours. Their production line is faster and more streamlined. No wonder they catch more business and make more money. Of course if *you* had more machines *you* would make more money too. Alternatively, if you had more money you could buy more machines. A vicious circle: but UDT can break it. UDT can lend you the money to buy the machines, and you can repay us with the extra money they bring in. Let's hear from you and we'll see what we can do.

UDT HELPS INDUSTRY TO HELP ITSELF

UNITED DOMINIONS TRUST (COMMERCIAL) LIMITED · UNITED DOMINIONS HOUSE · EASTCHEAP · LONDON EC3

Shop Refrigeration

(continued from page 62)

This window bed is 8 ft. long and 3 ft. deep and forms the bottom level of a three-tiered presentation of the richer and more decorative varieties of pastries and cakes, and the refrigerated level is particularly

Pioneering with refrigeration for confectionery window display: Sheratons Patisseries Ltd. Installation by Brett Daniels Ltd., Frigidaire distributors.

well suited for those containing cream.

The contents of the window are set off to advantage and given a visibly cool appearance by the use of pale blue laminated plastic (Formica) for the display surfaces.

NEW IWO CABINET

A new cabinet—model Master 100—was recently introduced to the United Kingdom market by M. L. Winsor & Co. Ltd. This attractive, glass-fronted cabinet is suitable for the display of dairy, cooked meats or delicatessen. It can be supplied with rear storage if required, and the refrigeration unit itself is remote from the cabinet. The standard of the materials used is of the usually high quality and the design and finish makes it an attractive addition to any shop.

* * *

NEW HOME FREEZER

The IWO range of farm freezers recently seen on M. L. Winsor's stand at the Smithfield Show, London, runs from a 4½ c.ft. model suitable for the small home to a box type cabinet of 20 c.ft. Those shown on the stand were model 130 which is a new small upright 4½ c.ft. machine designed like the normal refrigerator, with a working top of formica, and model 221 box type cabinet, with balanced lid, interior lighting and three wire baskets, of 13 c.ft. capacity. Model 130 is new to the United Kingdom market and, although it attracts purchase tax, is very reasonably priced.

* * *

Mr. P. Winter has been elected executive director of Easiclene Porcelain Enamel (1938) Ltd. The company is a member of the Owen organization whose chairman is Mr. A. G. B. Owen, C.B.E., the well-known Industrialist.

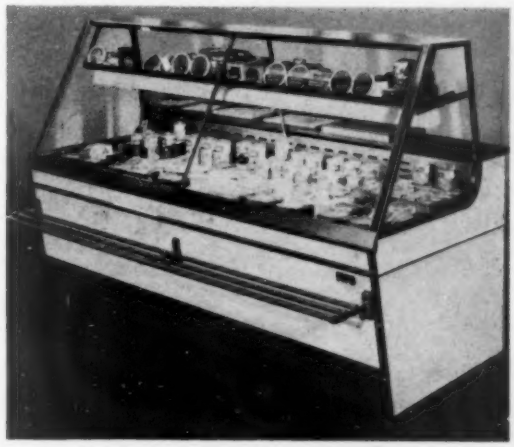
* * *

The Pressed Steel Company announce that **Mr. W. E. Lambourn,** joint deputy managing director of the company, has reached retirement age. Mr. Lambourn has given more than 34 years of valuable service to the company which extends to him its good wishes for a long and happy retirement. In consequence of Mr. Lambourn's retirement, **Mr. F. E. Cairns,** (previously joint deputy managing director) became deputy managing director on January 1, 1961. Also in consequence of Mr. Lambourn's retirement, and of the increasingly heavy demands of the company's expansion programmes, the following further adjustments are also announced: Mr. R. Craig becomes senior executive director; Mr. R. N. Davies becomes group director of manufacturing. Previously a local director, Mr. Davies has now been appointed to the main board of the company. Mr. S. C. E. Lewis becomes group supplies director. Previously a director of the car body division, Mr. Lewis has been appointed a local director. Mr. L. Long becomes deputy group director of manufacturing. Mr. S. A. J. Frampton takes over from Mr. Long as works manager, Cowley, and has been appointed a director of the car body division. Mr. A. H. Pether becomes group tool manager, and has been appointed a director of the car body division.

* * *

With the increasing use of electric lamp bulbs for indication as well as for illumination, more and more types of bulbs have come into use. **Vitality Bulbs Ltd.** who specialize in this field, have already produced no fewer than 1,400 different types of miniature and sub-miniature bulbs. The problem of how to provide, in a comprehensive easy reference form, details of their enormous variety of bulbs, has been solved by the production of a simple four-page folder giving an actual size illustration of each class of bulb available, with shape, fitting and voltage range in which it can be obtained. With this information designers and buyers with lighting or indicator problems to solve can easily select the bulb that most precisely meets their needs.

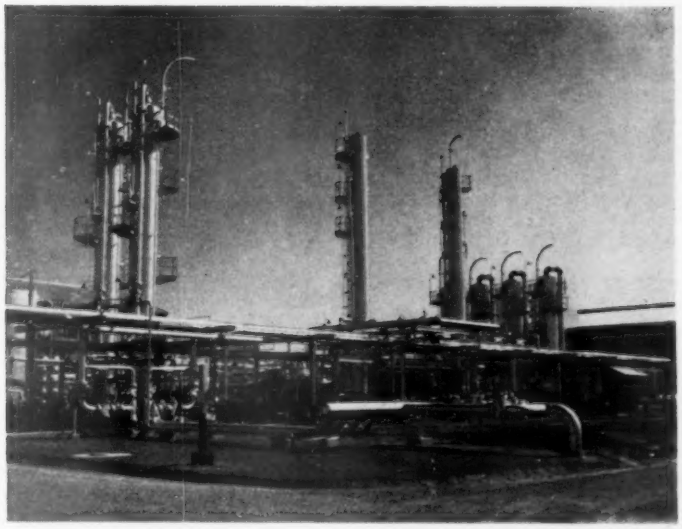
IWO's Master 100 cabinet.



THE SMITHFIELD SHOW
1960

The refrigeration stands at this popular December event: (1) J. & E. Hall Ltd.; (2) York Shipley Ltd.; (3) Smithfield Refrigerator Co. Ltd.; (4) Frigidaire Ltd.; (5) Prestcold; (6) M. L. Winsor & Co. Ltd.'s display of IWO cabinets; (7) Marco cabinets on a trade exhibitor's stand.

BUYERS' GUIDE



Gas treating area: Towers at left are absorbers where carbon dioxide and some water vapour are removed from the helium-bearing natural gas by contact with a glycol-amine solution. Towers at centre and right of centre are stripping towers for continuous regeneration of the glycol-amine solution. Four towers at right (three visible) are fixed bed drying towers containing activated bauxite where the helium-bearing natural gas is dried to a dew-point of minus 100°F. or less prior to extraction of the helium in the low temperature gas liquefaction process.

NEW HELIUM PLANT

DEMANDS for helium in the U.S.A. have for the past several years exceeded production capacity. About 80 per cent. of the helium produced goes directly to Federal agencies, and an additional 10 to 15 per cent. goes to companies having defence-related contracts with Government agencies. This means that 90 to 95 per cent. of the total production has Federal applications.

During the fiscal year 1958 the annual helium production capacity of the four U.S. Government-operated helium plants, located at Amarillo and Exell, Texas ; Shiprock, New Mexico ; and Otis, Kansas, was about 340,000,000 c.ft. In 1959 a new helium plant was constructed at Keyes, Oklahoma. This plant is expected to have a production capacity of about 290,000,000 c.ft. of helium per year, which will give a total annual helium production capacity of at least 600,000,000 c.ft.

The Keyes helium plant is located in the Oklahoma Panhandle. The process of helium separation used at the plant is a low-temperature one in which, in the first step, the natural gas is cooled to about –250° F. and, in the final purification step, a temperature as low as –340° F. is reached. The process is a continuous one ; consequently, in the preliminary gas-conditioning process, all components in the gas that will freeze at these temperatures have to be removed. Water vapour in the natural gas obviously must be reduced to a low level. Carbon dioxide and hydrogen sulphide, if present, must be removed from the gas because the freezing points of these are –109° F. and –122° F., respectively—temperatures much higher than –250° F. to which the gas is cooled.

Gas coming from the gathering lines of the Colorado Interstate Gas Company, principal operator of the Keyes gas field, enters the helium plant at a pressure above 450 p.s.i.g., operating pressure of the gas-conditioning equipment. Before going to the regulator controlling this pressure, the gas passes through an entrainment vessel where any liquids present are removed. It then goes to an oil-bath cleaner of the moving-curtain type where solids and mists are removed. After pressure regulation to 450 p.s.i.g., the gas is split into two equal streams, each going to identical carbon dioxide removal units. The units are bubble-tray type contactors designed for 35 m.m.c.f.d. each. A solution of monoethanolamine-diethylene glycol-water in the respective proportions of 15–75–10 weight per cent. is used to contact the gas for carbon dioxide and hydrogen sulphide removal. The carbon dioxide content of the incoming gas is about 0·7 mole per cent., and the hydrogen sulphide content is virtually zero. The inlet gas stream is essentially water saturated at inlet temperature and pressure conditions.

A solution composed of amine and glycol instead of amine alone is used for two reasons. The glycol helps to reduce foaming in the contactors and the high percentage of glycol partially dehydrates the gas. This results in less water to be removed in the dehydrating system through which it next passes. The gas leaves the carbon dioxide

removal contactors at a temperature of about 20° higher than it enters, owing to the reaction between the carbon dioxide and the amine solution, and is taken to a cooling tower section where it is cooled to about 70° F. or lower, depending upon the atmospheric temperature. To augment the removal of water, the two streams are joined together and enter as a single stream into a separate dehydrating contactor supplied with highly concentrated amine-glycol as the scrubbing medium. This mixture is obtained from the main body of amine-glycol solution used in the carbon dioxide removal process by taking a small portion of the regenerated amine-glycol solution to a separate reboiler. Here, the solution is heated to about 300° F., which removes some of the water, reducing it to about 3 per cent. A considerable portion of the amine in

Crude helium separation units: The three units where helium is extracted from helium-bearing natural gas by a low temperature gas liquefaction process are shown outside the separation building.

the feed solution boils off with the water and is condensed along with the water, both of which are returned to the circulating amine-glycol storage tank. The water dewpoint of the gas stream leaving the dehydration contactor is about 30° F.

The carbon dioxide removal process is provided with an amine-glycol solution reclaimer. A small side stream of the regenerated amine-glycol solution passes to the reclaimer where a gas-fired boiler is used to boil off under vacuum the amine and glycol which is condensed and recovered. The degradation products are drawn from the boiler and discarded. The reclaimer is a standard commercial package unit.

After leaving the dehydration contactor, the single gas stream is split into two equal portions, each of which enters the base of a bauxite-filled dehydration tower. Each tower is designed for 35 m.m.c.f.d. and operates at 450 p.s.i.g. The gas flow is upward through the towers during the drying cycle and downward during the regeneration cycle. Each of the dehydration towers is equipped with three screen trays on which the bauxite rests. Manholes on the side of the towers, at the top and bottom of each tray section, permit removing and loading the desiccant in each section independently of the others.

A fourth top tray section in each tower holds a trimmer bed of molecular sieves. This bed is designed to reduce the water dewpoint of the exit gas to –100° F. or lower. Tests have shown that this dewpoint in the natural gas is being accomplished. The very small residual amount of water remaining in the gas stream does not appear to be difficult to handle in the low-temperature helium separation process.

The dehydration units are regenerated with gas from the outlet of the helium separation equipment. This gas has a very low water content since it was previously dried to a low dewpoint before being processed and comes from equipment operating at –250° F. The use of this gas assists in effectively drying the solid desiccants, bauxite, and molecular sieves. The regeneration gas is available at a pressure of about 180 p.s.i.g., and the dryers are regenerated at this pressure. Gas flow is downward during regeneration and subsequent cooling. This downward gas flow results in the upper portion of the desiccant bed being dried most intensively, and since it is the outlet bed on the drying cycle, it produces the driest gas possible when the units are switched to drying.

The regeneration gas is heated in a direct-gas-fired heater. This eliminates the hazard of getting moisture into the regeneration gas owing to a possible leakage of steam from a steam-heated unit, such as has been experienced occasionally at other plants. After regeneration, the dehydration units are cooled with gas from the same source used in the regeneration cycle. This gas, as mentioned above, is extremely dry ; hence, does not add water to the outlet desiccant bed of the drying cycle.

When the natural gas has been thus conditioned in the two dehydration units, it is brought together into a single stream and then is divided into two or three streams, depending upon the quantity of gas being processed and the number of helium separation units used. The plant has three helium separation units or " coldboxes " and each stream goes to a separate unit. These coldboxes are each designed for a flow of 23·3 m.m.c.f.d. ; it has been found, however, that they are capable of processing as much as 30 m.m.c.f.d. or more ; hence, under average conditions, two units can handle the entire gas

Central control room: Operation of the gas treating units, crude helium separation units, and the helium purification units is controlled from the central control room. The equipment controls the major process steps and advises the operators on the status of important phases of the processing.

stream entering the helium plant. This allows a unit to be shut down without interrupting or reducing the over-all gas flow through the plant when it is necessary to do repairs. The gas enters the coldboxes at 450 p.s.i.g., and normal temperature which is about 80° F. and is cooled through heat exchange with the outgoing gas stream to about –250° F. At this temperature and pressure, the gas stream is about 97 per cent. condensed with only the helium and a small amount of nitrogen and methane remaining as a gas. At this point in the process, the combined stream is reduced in pressure to 225 p.s.i.g., by

throttling into a liquid-gas separator. A few degrees of cooling takes place upon throttling and there is a small amount of flashing of the liquid into vapour. The principal advantage is that helium that was in solution in the liquid at the higher pressure is flashed out of solution when the pressure is dropped, thus improving the helium recovery of the process.

The equilibrium gas phase from this separator passes through a rectifier section cooled with liquid nitrogen

Separation building interiors: At right, behind the operator, are the insulated housings for expansion turbines on the crude helium separation units. Refrigeration to sustain the process is supplied to each unit by expanding nitrogen at 600 lb. through two expansion turbines operating at speeds between 31,000 and 67,000 revolutions per minute. At left are the five helium purification units.

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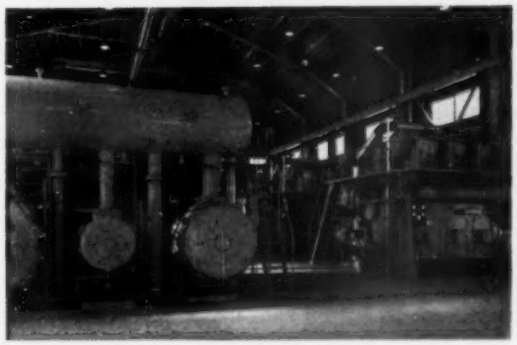
The liquids in the separator emerge through a bottom outlet and are throttled to the return path of the heat exchanger system. The outlet pressure of the return system is about 180 p.s.i.g., and the liquids from the separator are warmed and evaporated on their way out by the entering gas stream. Before leaving the heat exchangers, they are completely gasified and warmed to a temperature within 8° or 12° F., of the inlet gas.



Compressor building interior: On the right is shown one of three 2,000 h.p. gas engine-driven compressors which compress the helium-free natural gas from the crude helium separation units and delivers it to the pipeline company. Each of the compressors is designed to compress 23.3 million cubic feet of processed gas per day from 168 p.s.i.g. to 450 to 650 p.s.i.g. On the left is shown one of three 2,500 h.p. gas engine-driven compressors which compress nitrogen for refrigeration for the crude helium separation and purification units. Each of the compressors is designed to compress 8.3 million c.ft. of nitrogen per day from zero to 600 p.s.i.g.

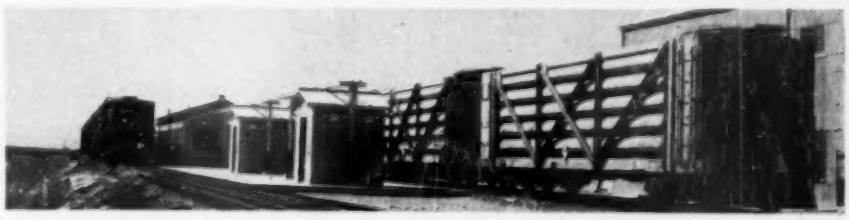
The processed gas streams from the coldboxes join together in a line leading to the suction of compressors that boost the pressure from 180 p.s.i.g., to 450 p.s.i.g. or higher to put the gas back into the Colorado Interstate Gas Company's transmission line.

Crude helium from the main helium separation cycle goes to purification equipment operating at temperatures as low as -340° F. In the final stage of purification, the helium is compressed to 2,700 p.s.i.g., and passes through activated charcoal maintained at -320° F. The helium leaves the plant with a purity of 99·995+ mole per cent. and goes directly to shipping containers. Most of the helium is shipped in railway tank cars at pressures exceeding 2,200 p.s.i.g.

Because of the very low temperatures used in the helium-extraction process, the need for complete gas conditioning is obvious. For gas transmission lines, it is normally not necessary to remove carbon dioxide from the gas. Only in cases where the carbon dioxide content is high is this necessary. For such cases, some other method of removal might be cheaper than the amine process and thus be preferred.

Prime contractor for the construction of the Keyes plant was the Fluor Corporation Ltd., of Los Angeles.

All helium produced at the Keyes plant is shipped as a compressed gas in specially designed railway wagons. The wagons are made of 30 permanently mounted steel cylinders and are filled to pressures up to 4,000 lb./sq. in. Average capacity of the cars is about 250,000 c.ft. The small sheds between the tracks house piping manifolds from which wagons are filled.



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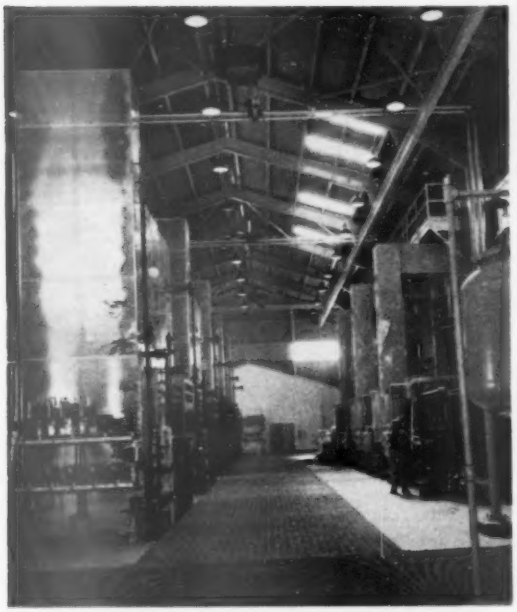

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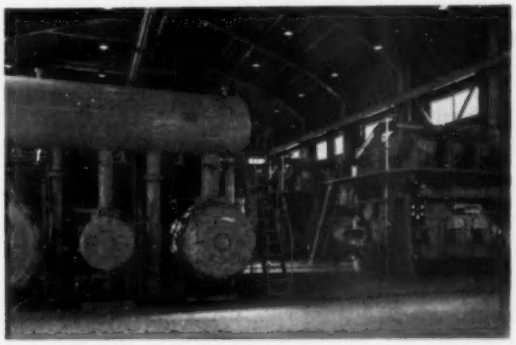

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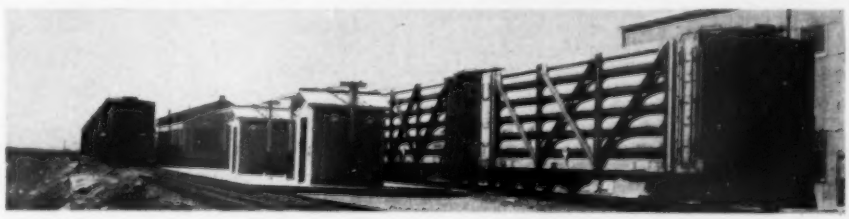
Prime contractor for the construction of the Keyes plant was the Fluor Corporation Ltd., of Los Angeles.

All helium produced at the Keyes plant is shipped as a compressed gas in specially designed railway wagons. The wagons are made of 30 permanently mounted steel cylinders and are filled to pressures up to 4,000 lb./sq. in. Average capacity of the cars is about 250,000 c.ft. The small sheds between the tracks house piping manifolds from which wagons are filled.



PATENTS

APPLICATIONS RECEIVED

October 7—Leybold-Hochvakuum-Anlagen, G.m.b.H., C34532, Freeze drying plant, etc. 10—Whittington, P. E., C34582, Air-conditioned fuel handling suit. 13—Mott, J. P35071, Refrigerator cabinets. 20—Heat Pump & Refrigeration Ltd., Komedera M., and Simpson, A. R., P35949, Containers coolers ; Licentia Patent-Verwaltungs-G.m.b.H., Dunkel, G., and Sternfeld, G., C36015, Refrigerators. 24—Commissariat A l'Engergie Atomique, C36446, Thermal insulating materials. 27—Stal Refrigeration A.B., Conradi, H., C36938, Refrigeration plant. November 4—Hall Ltd., J. & E., Farmer, J. D., P37932, Compressors. 9—Tessler, A., P38515, Refrigerating devices. 16—Westinghouse Electric Corporation, C39344, Thermoelectric cooling device. 18—Dowty Rotel Ltd., Hayward, A. J., and Mapp, A. G., P39776, Electrical de-icing devices. 19—General Motors Ltd., Williams, C. E., P39859, Frozen-food display cases. 22—Air-Conditioning & Engineering (N.I.) Ltd., and Brown, O. S., P 40086, Fluent material dispensing apparatus. 23—Heat Pump & Refrigeration Ltd., Komedera, M., and Simpson, A. R., P40329, Cooling systems.

COMPLETE SPECIFICATIONS ACCEPTED

November 2—Borkat, P., 857,164, Humidifier for use in air-conditioning plant ; Bosch G.m.b.H., R., 857,396, Refrigeration apparatus. 9—Fingscheidt, G.m.b.H., Refrigerator locks ; Howa Sangyo Kabushiki Kaisha, 857,728, Absorption refrigerator ; Tyler Refrigeration Corporation, 857,972, Shops ; Owens-Corning Fiberglas Corporation, 857,895, Methods of making thermal insulation products ; General Motors Corporation, 857,999, Refrigerators ; Fingscheidt G.m.b.H., F., 857,925 and 857,926, Refrigerator locks. 23—Dairy Supply Co., Ltd., 859,212, Control of refrigerating apparatus ; Porter & Co. (Salford) Ltd., T., 859,093, Means for controlling temperature in thermally insulated vessels ; Jackstone Froster Ltd., 858,950, Refrigeration apparatus ; Vyzkumny Ustav Strojic Chladicich A Potravinarskych, 859,060, Refrigeration plant ; Pressed Steel Co., Ltd., 859,113, Refrigerator cabinets ; Stierlin, H., 858,922, Absorption-refrigerating unit with pressure-equalizing gas ; Bolinder's Fabriks, A.B., 859,000, Absorption refrigerating apparatus operating with inert gas ; Hall, Ltd., J. & E., 858,957, Production of ice blocks. 30—Jarrett Corporation, 859,668, Control means for air-conditioning systems ; Dole Refrigerating Co., 859,518 Combined cooling and heating element ; Worthington Corporation, 859,702, End bell adapters for hermetic and open-type refrigeration compressors. December 7—Celleco, A.B., 860,105, Method and means for the transfer of heat in refrigerating systems.

New Companies

The accompanying particulars of New Companies recently registered are taken from the Daily Register compiled by Messrs. Jordan and Sons Ltd.

Glacial Refrigeration Ltd., 46, Mostyn Street, Llandudno. Secretary : Winifred M. Odd. To carry on business of radio, television, electrical and electronic engineers, refrigeration engineers, etc. Nominal capital : £5,000. Directors : Leslie G. Odd and Winifred M. Odd, Woodville, 157, Compstall Road, Romiley, Ches.

Branch & Gurr Ltd., 6, Gate Street, W.C.2. Secretary : Daisy L. Branch. To carry on business of heating, ventilating and air-conditioning engineers, etc. Nominal capital : £1,000. Directors : David J. Branch, " Viomond," Crowhurst Road, Lingfield, Surrey. Ronald F. Gurr, 87, Akehurst Close, Copthorne, Sussex.

Bow Engineering Co. Ltd., Howland House, Howland Street, W.1. Secretary : Maria G. Pelosi. To carry on business of refrigeration engineers, etc. Nominal capital : £100. Directors : Maria G. Pelosi, 140, Stradbroke Grove, Ilford ; Cyril F. Hawkes, 24, Sorrento Road, Sutton, Surrey ; Teressa Fuschillo, Nicholas Fuschillo, Artura Pelosi and Maria G. Pelosi.

Lowestoft Ice Co. Ltd., Nominal capital : £100,000. Directors : David F. Cartwright, The Close, Barsham, Beccles ; Arthur W. Suddaby, Clayesmore, Marine Parade, Gorleston-on-Sea ; David M. Forster and Basil A. Parkes, addresses not stated.

Bob Meek Refrigeration Ltd., 24, Castle Street, Barnstaple. Secretary : E. L. Loudwill. Nominal capital : £2,000. Directors : Robert D. Warren-Meek and Mrs. M. M. Warren-Meek, 24, Castle Street, Barnstaple.

Masscold (North East) Ltd., 34, Blanchland Avenue, Woodland Park Estate, Wideopen, Newcastle upon Tyne, 3. Secretary : H. J. Forrest. To carry on the business of manufacturers of and dealers in refrigerators and refrigerating plant. Nominal Capital : £2,000. Directors : W. E. Delany, 26, Priory Road, Cottingham ; Stanley Cowie, 37, Broadmain Avenue, High Barnes Estate, Sunderland ; Henry J. Forrest, 34, Blanchland Avenue, Woodland Park Estate, Wideopen, Newcastle upon Tyne, 3.

Exhibition Appliances Ltd., 334, Kennington Park Road, S.E.11. Secretary : J. L. Hutson. To carry on business of refrigeration and cold storage engineers, etc. Nominal Capital : £5,000. Directors : James L. Hutson, 419, Hillcross Avenue, Morden ; Arthur Head, 64, Brightwell Crescent, Tooting. Solicitors : Henry I. Sydney & Co., S.E.11.

Jason Refrigeration Co. Ltd. Nominal Capital £100. Directors : to be appointed by subscribers. Subscribers : Reginald G. Fraser, 13, Franklin Road, Brighton (clerk) ; William A. Coomber, 81, Princes Crescent, Brighton (clerk). Solicitors : Howlett & Clarke, Brighton, 1.

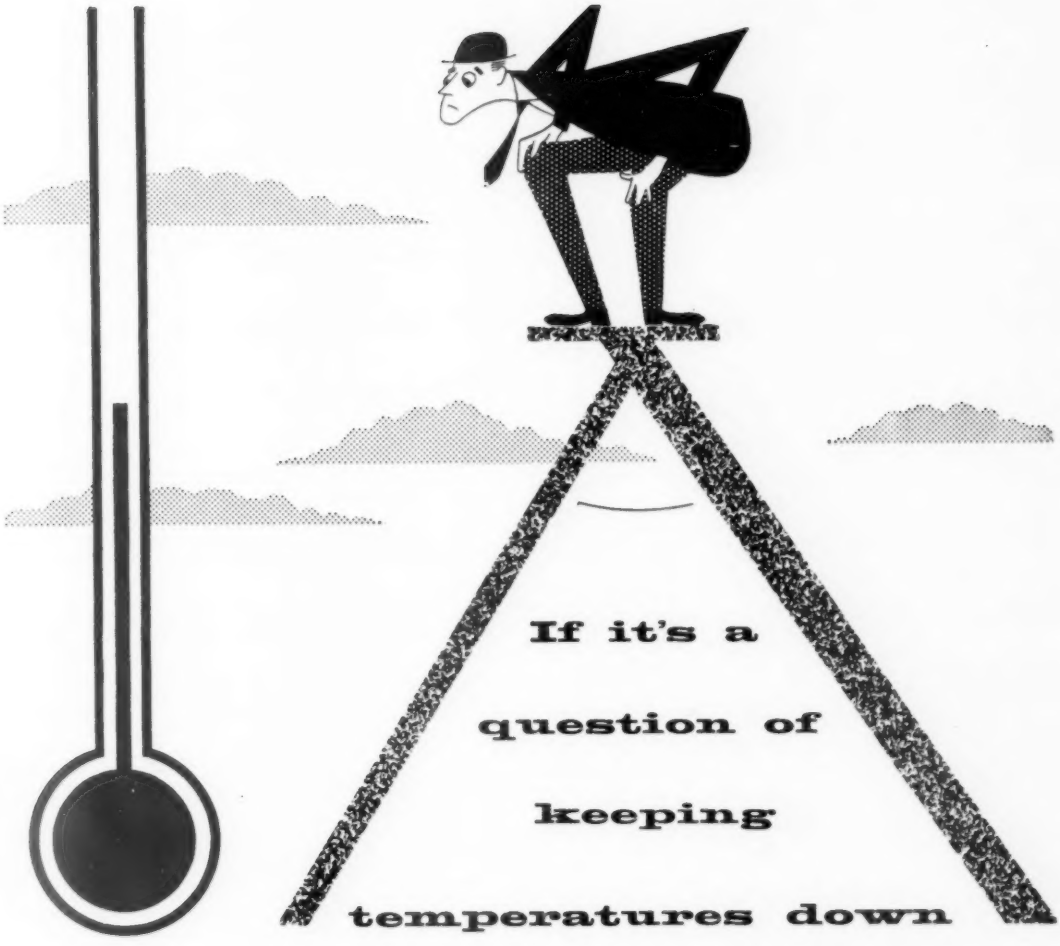
Partons Refrigeration Services Ltd. Nominal Capital : £100. Directors : Walter H. Parton, 138, Dawberryfields Road, Kings Heath, Birmingham. Peter A. Hopkins, 28, Hawthorn Road, Sutton Coldfield. Solicitors : Geoffrey Parker & Bourne, Stratford-upon-Avon.

Williams Cold Storage (King's Lynn) Ltd. Nominal Capital : £20,000. George I. Williams, The Canons, Brandon Road, Thetford, Norfolk, signs as director. Subscriber : Ronald S. Dicks, White Lodge, Nugents Park, Hatch End.

Queensway Electrical Ltd., 97, Queensway, W.2. Secretary : C. Bryett. To carry on business of manufacturers of and dealers in washing machines, refrigerators, etc. Nominal Capital : £100. Director : Harold Freedman, 69, Grove Crescent, N.W.9.

Cape Insulation and Asbestos Products Ltd. To take over that part of the business of manufacturing and selling asbestos mineral wool and other insulation and composition products now carried on by the Cape Asbestos Co. Ltd., etc. Nominal Capital : £100. Director : to be appointed by subscribers. Subscribers : T. C. Hale and R. N. Dent. Registered by Solicitors : Holmes, Son & Pott, E. C.

INDEX TO ADVERTISERS



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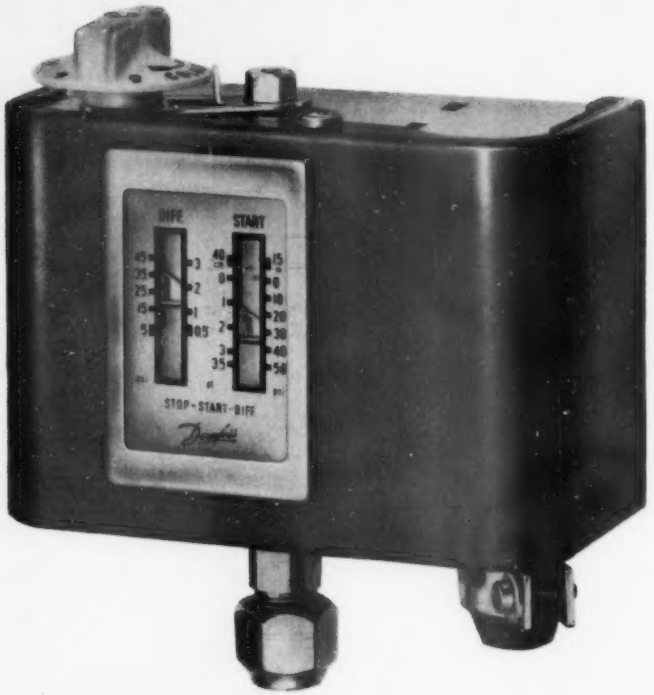

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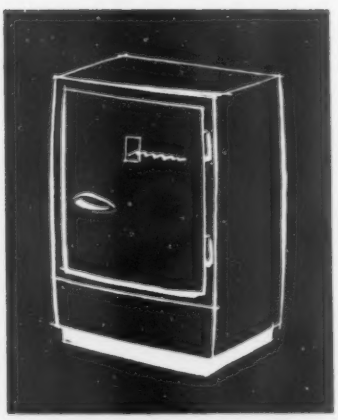

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